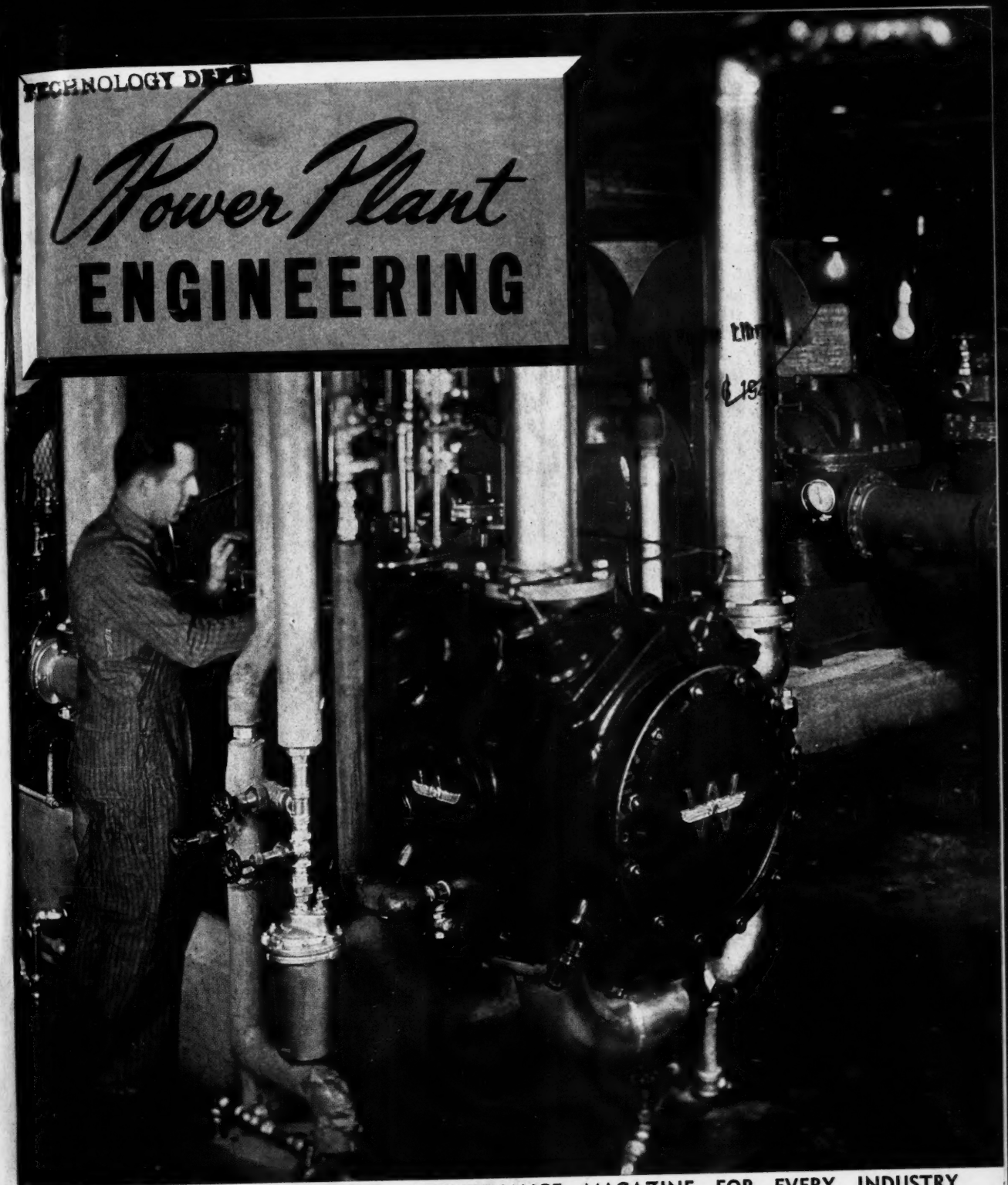
TECHNOLOGY DEPT

Power Plant ENGINEERING



THE POWER ENGINEERING AND MAINTENANCE MAGAZINE FOR EVERY INDUSTRY

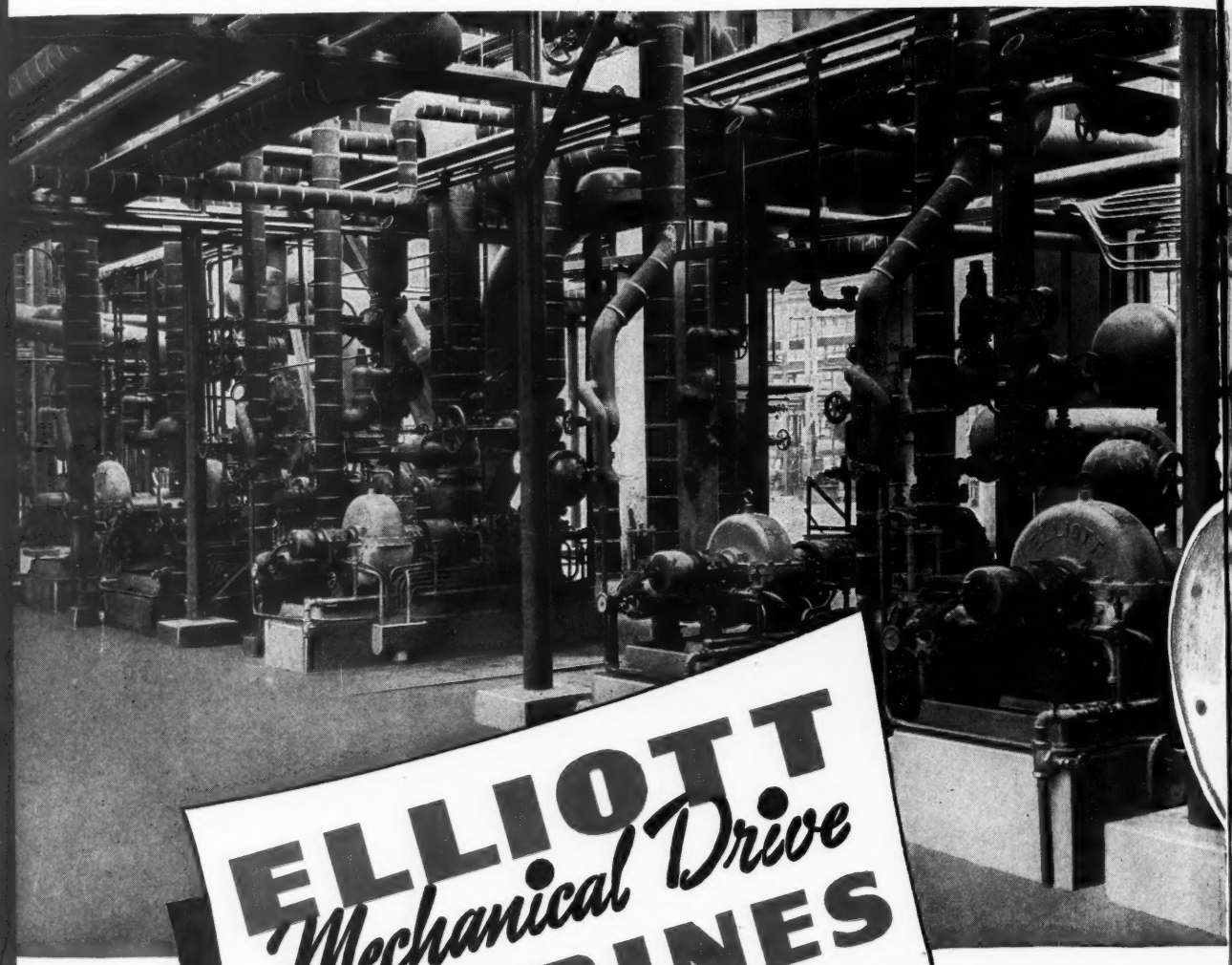
JULY • 1946

Features

MODERNIZING ROCKFORD · MAGNETIC DRIVES · ENGINEERING OF WATER TREATMENT · FIBROUS GLASS · SILICONE GREASES FOR BEARINGS · SPRINGDALE ADDS 80,000 KW · BURNING COAL, OIL OR GAS · ATOMICS · · · · CONTENTS PAGE 5

R V. 50 a July - Dec. 1946

The kind of drive t



ELLIOTT Mechanical Drive TURBINES

are lined up in the photo above, driving the main process pumps in a western refinery. This plant has hundreds of Elliott turbines and is one of the many plants which have standardized on tough, trouble-free Elliott turbines for responsible drives.

ELLIOTT PRODUCTS INCLUDE

Steam Turbines—Generators—Motors—Condensers—Feedwater Heaters and Deaerators — Steam Jet Ejectors — Centrifugal Blowers—Turbochargers for Diesel Engines—Tube Cleaners—Strainers—Desuperheaters—Filters

Tech

they Standardize on ELLIOTT!

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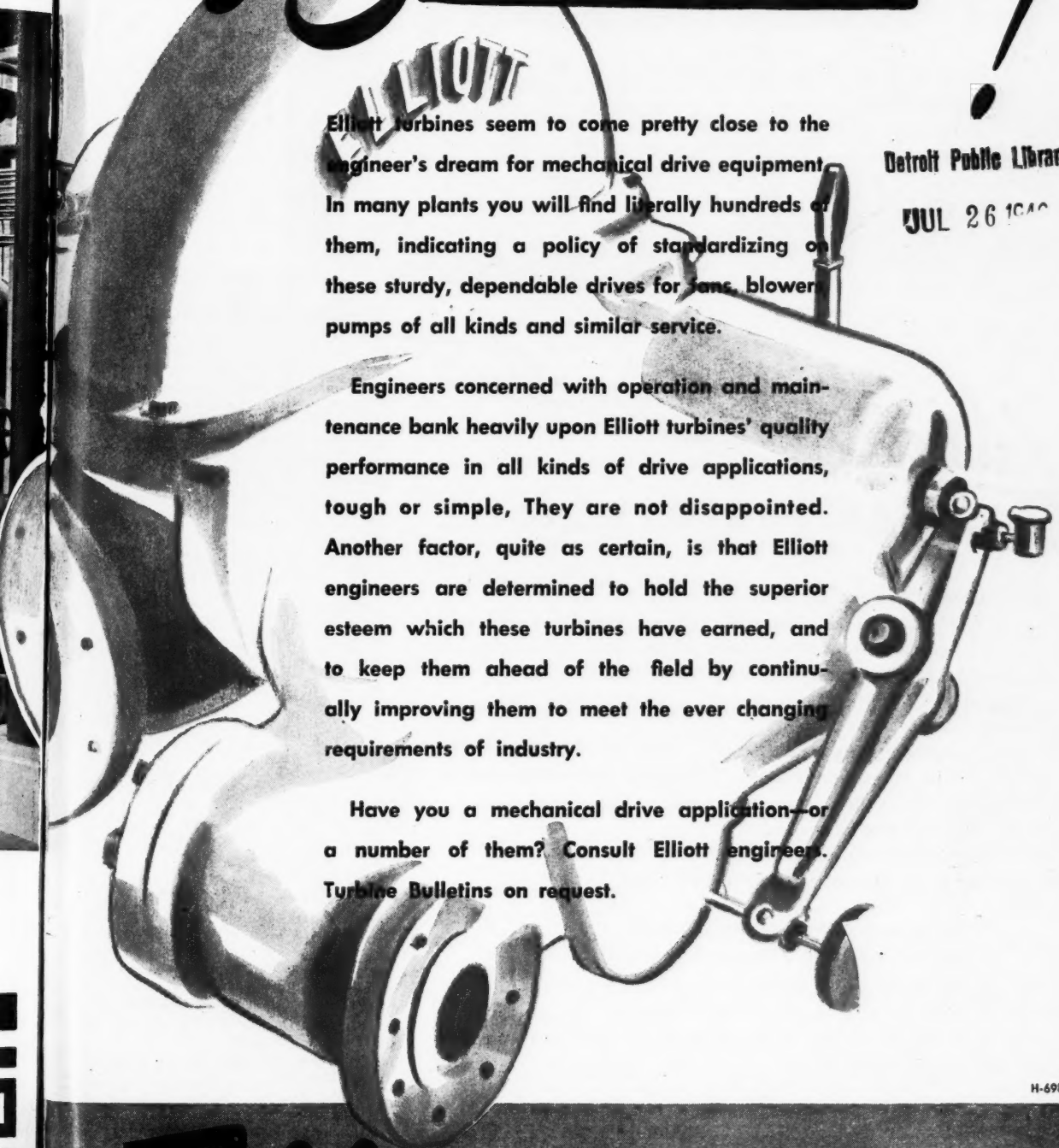

Elliott turbines seem to come pretty close to the engineer's dream for mechanical drive equipment. In many plants you will find literally hundreds of them, indicating a policy of standardizing on these sturdy, dependable drives for fans, blowers, pumps of all kinds and similar service.

Engineers concerned with operation and maintenance bank heavily upon Elliott turbines' quality performance in all kinds of drive applications, tough or simple, They are not disappointed. Another factor, quite as certain, is that Elliott engineers are determined to hold the superior esteem which these turbines have earned, and to keep them ahead of the field by continually improving them to meet the ever changing requirements of industry.

Have you a mechanical drive application—or a number of them? Consult Elliott engineers. Turbine Bulletins on request.

H-698

Elliott COMPANY

Steam Turbine Dept., JEANNETTE, PA.

Plants at JEANNETTE, PA.—RIDGWAY, PA.
SPRINGFIELD, O.—NEWARK, N. J.

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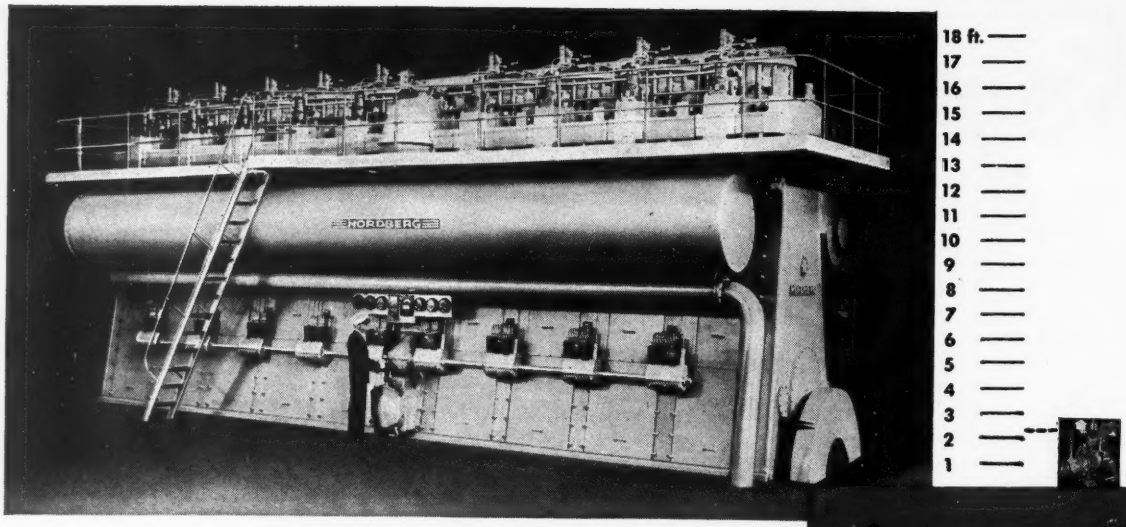


Largest U.S.-built Diesel is the 9-cylinder Nordberg at the left, developing 6000 s.h.p. at 160 r.p.m. This giant has a 29-inch bore and 40-inch stroke, measures 41'4" long and 23'5" high overall, and stands 18'2" from floor to top of engine. Now in operation in U. S. Lines vessel lubricated with *Texaco Ursa Oil.*

Largest to Smallest

PEAK PERFORMANCE

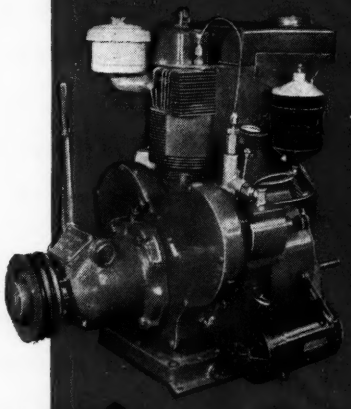
REGARDLESS of size or type, you'll get peak performance from your Diesels by lubricating with *Texaco Ursa Oils.* These famous oils have been kept in step with Diesel engine developments over the past 30 years. They keep engines clean . . . assuring active valves, free rings, proper seal . . . efficient, full-power operation.

Texaco Ursa Oils greatly reduce wear, and prolong the life of bearings, liners, rings and pistons. Their use assures lower maintenance and fuel costs. There is a complete line of *Ursa Oils* to meet every Diesel requirement.

All leading Diesel engine manufacturers approve *Texaco Ursa Oils,* and they are used by operators the world over. In the United States—

More stationary Diesel h.p. is lubricated with Texaco than with any other brand!

For Texaco Products and Lubrication Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



Smallest U.S.-built Diesel is the new, one-cylinder, air-cooled Sheppard, shown above in scale with the Nordberg. It develops 3¾ h.p. at 1800 r.p.m. and has a 3-inch bore and 4-inch stroke. Overall dimensions: 38½" high and 22½" long. *L. H. Sheppard Company approves lubrication with Texaco Ursa Oil.*

TEXACO

TEXACO Ursa Oils

FOR ALL DIESEL ENGINES

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT—CBS

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Power Plant ENGINEERING

July, 1946

VOLUME 50—NUMBER 7

Cover: Shows steam-driven 570-cfm air compressor providing air for operating elevator doors, dry sprinkler system, air conditioning controls at Carson Pirie Scott & Co., Chicago. In background, 1500-gpm fire pump driven by 200-hp motor.

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Contents of back issues of Power Plant Engineering will be found in Industrial Arts Index on file in Public Libraries.

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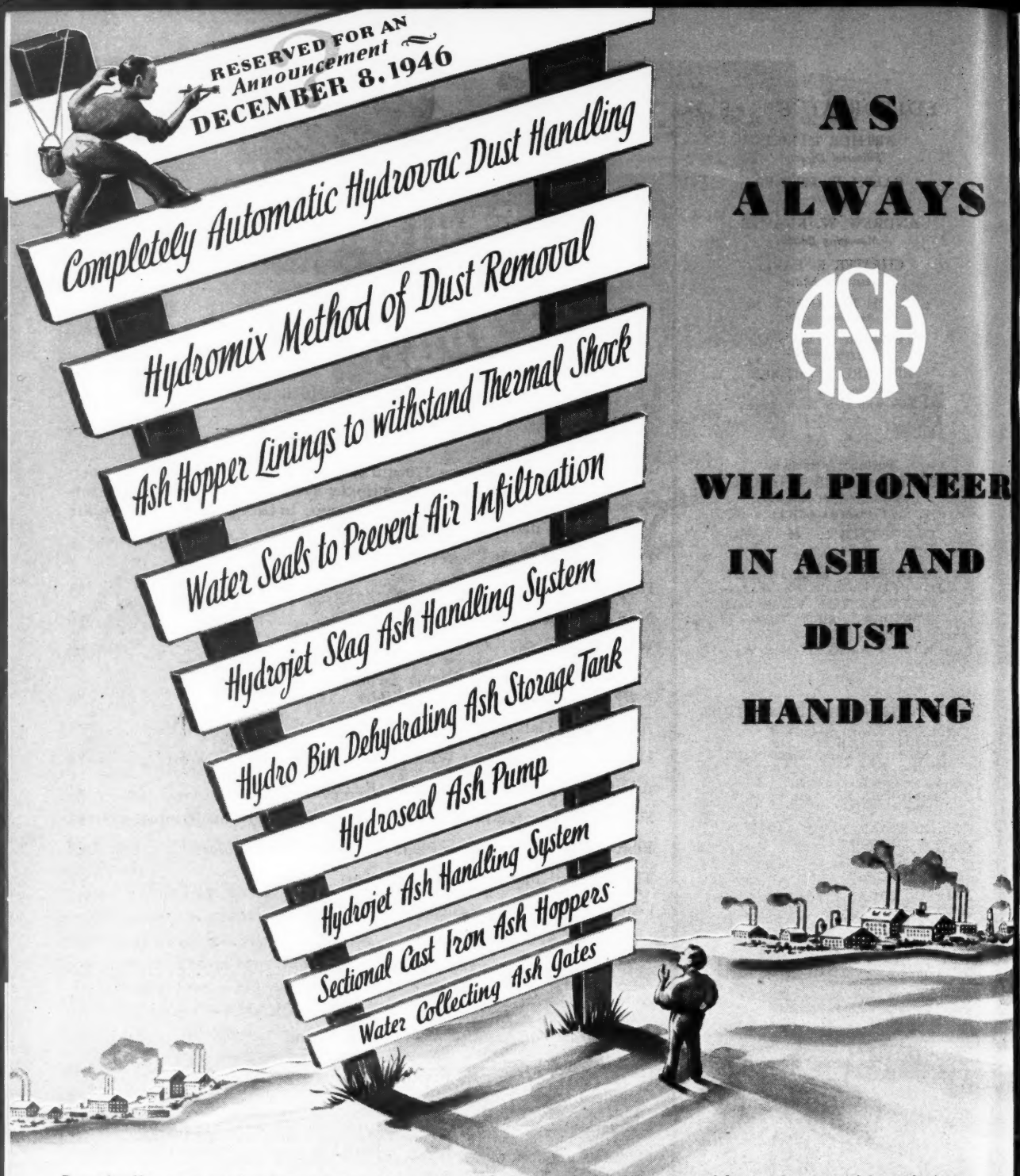
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Water Seals to Prevent Air Infiltration
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WILL PIONEER IN ASH AND DUST HANDLING

Practically ever major improvement in ash and dust handling during the past quarter century has been pioneered and developed by The Allen-Sherman-Hoff Co. No, we don't take full credit, for without the assistance and cooperation of the country's leading consulting and power plant engineers, we could not have achieved these successes. But of this one thing you may be sure "as always, A-S-H will pioneer in ash and dust handling." If you don't have all the facts regarding Automatic, Remote Control Hydrovac Dust Handling you are missing something.

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Front Lines—

IN A RECENT iew, R. Buckminster Fuller, creator of the Dym luminum-plywood-plexiglass house that looks like ver over a plate of toast in a dining car, emitted t wing:

"Today Hous ery confused thing. Lamps fall down and hit Children on the head. Mother is exhausted from dishwashing and cannot give intellectual reflection to the questions posed by Children. Fuller House solves these problems—kitchens complete with refrigerator, dishwashing machine, sink, range and garbage disposal units. Time for rest and relaxation, and intellectual effort in relation to questions posed by Children."

Somebody ought to stuff a handkerchief into R. Buckminster Fuller's mouth before he says that again. Does it remind you of Jabberwocky? or Gertrude Stein? Reporting this, *Harpers* P & O editor screams in anguish, "My God, Fuller! Did you ever *listen* to the things kids *ask?* We assure you a stack of dirty dishes provides a handy excuse for avoiding questions even a Dymaxion mother would find it difficult to answer." Our own reaction is as follows; to wit; viz.: Screw the lamps in tighter.

ADVANCES made in the injection molding processes of mycalex during wartime and improved methods that have resulted in reduced tool costs are certain to make this material economically practicable for an increasing number of industrial applications. Before the war mycalex in molded form was used almost entirely for electronic equipment because of the limited number of shapes which could be produced. Ability to injection mold the material into such a variety of shapes today opens the way for a great broadening of uses for industrial applications. Uses to which the material will be put will quadruple in the next five years when the product will be applied extensively in rotating equipment, control equipment, heating devices, motor parts, welding equipment and insulation for aeronautical ignition equipment, to mention a few.

KING COTTON is on his way to the egress. During the next decade, he will cease to be the major factor in the activities of the South. Further development of the mechanical cotton-picker and the mechanical cane cutter, plus the shift of the Southern farmers from cotton-growing to lumber, grain, cattle and vegetable farming, constitute a revolution, already well under way in Southern agriculture, that promises to develop a mighty sweep during the coming decade. So asserts Peter F. Drucker, who also points out the high price of this revolution. It may in the end benefit the South and the whole country, but in the meantime it will create one of our most serious problems in handling the millions of Negroes and whites, now engaged in the great cotton-raising industry, who will be displaced by its mechanization. A plan has already been devised by the U. S. Bureau of Agricultural Economics for cushioning the effects of this revolution. But if the challenge is not met, says Mr. Drucker, the South and the nation will be in for real trouble.

BRAILLE, a trained dog and a few gadgets—are these the best we can offer a blind man in this new "atomic" age? Radio and the Talking Book are not eyes. Less than 1000 blind persons successfully use a Seeing Eye dog. Well, how about radar? If a rocket can be radar-guided to kill people, why can't a blind man use it to help him live? As you might have suspected, Dr. Vannevar Bush thought of that during the war and formed the Committee on Sensory Devices. According to Dr. Paul A. Zahl this committee has done much work in an attempt to develop some really effective, simple devices for the blind. It is still too early to say that these will be practicable. Can we use radar as an artificial "bat eye" to guide a blind person in walking? After all, the bats can do it, so there must be an answer. Can we develop a reading machine that will scan printed words and translate them into sound? Or even into intelligible English? The problems have been defined, but no ultimate solutions are yet in sight. Yet, if there is a solution latent in our vast and growing technology, says Dr. Zahl of the Haskins Laboratories, who is doing much of the investigating, it will be found eventually.

WASTE PREVENTION is a major item in the oil industry today. But conserving oil is not the same as saving a commodity like gold, which can be purified and then buried in a Fort Knox for later use. Oil and gas are combinations of hydrogen and carbon atoms called hydro-carbons. Some of these are volatile and thus do not lend themselves to long storage anywhere but underground. Scientists have worked out ways of controlling the flow of oil and gas from underground reservoirs, however, and an interesting article in the April, 1946 issue of *The Lamp,* explains how these petroleum products are stored in the ground, the methods used for locating them and conserving them in the most economical way. In doing this many legal questions arise which vitally effect the conservation methods that must be used; these also are explained and cleverly illustrated.

"JUST FOR A MOMENT completely forget about the broad general national problems of political and social strife, strikes and lockouts, and think only of your own business. Now ask yourself these two questions: I. Do I give employees a fair wage? II. Do my employees give me a fair day's production? If the answer is 'no' to either question then something is seriously wrong with your wage administration policies. If there is doubt in your mind, the correct answers to these two questions can be easily and quickly obtained by determining your use of two techniques in management which have been proved in industry over the past twenty-five years as essential to good personnel relations: 1. Job evaluation; 2. Evaluated-Rate-Standards." —John D. Corrigan of Corrigan, Osborne & Wells, Inc.

FRONT LINES readers may remember that we have frequently called attention to the views of Dr. Gustav Egloff about our petroleum resources. He feels that these resources are somewhat greater than the 15 or 20 years' supply that most authorities agree is about all we have left. Now another theory is being advanced to the effect that our petroleum products in the ground are the end-result of continuous radio-activity upon organic matter. This is somewhat different from the theory so long held that in prehistoric times, terrific heat and pressure on plant and animal remains created petroleum, coal, gas and similar fuels. We don't know whether or not Dr. Egloff may have been thinking of this new conception when differing with the pessimism of so many of his colleagues. At any rate, the theory will be thoroughly investigated and it will certainly be a break for the human race in general and ourselves in particular if it turns out to be correct.

SPECIAL IMPORTANCE is attached to the report on the German salt industry included in the March 20, 1946, issue, Vol. 22, No. 3 of *Mineral Trade Notes.* This is because its extensive salt resources before the war enabled Germany to hold an important place in the world of chemicals and thus obtain substantial foreign credits through export of large quantities of salt and sodium compounds derived therefrom. The *Notes* also include a fairly comprehensive report on the iron ore industry in Italy. Long-term reports cover monazite production in India for 35 years; the cement industry in Cuba from 1906 to 1944; data on diamond exports from British Guiana from 1926 to 1945.

PLANS ARE UNDER WAY for the formation of a Mexican organization, on the lines of the Tennessee Valley Authority, to develop and irrigate large areas of potentially rich farm land, to generate electric power for wide distribution and to integrate existing irrigation and other projects. These plans are being credited to Miguel Aleman, a candidate for the Mexican presidency in the coming election of July 7. He proposes to carry out these plans in the valleys of the Fuerte River in Sinaloa and the Papalapan River in Vera Cruz.

BY THE USE of a new precision radar system developed during the war, experts of the Army and the U. S. Coast & Geodetic Survey plan a complete remapping of the earth. The radar system can measure great distances around the globe by shooting out electronic signals from high-flying airplanes.

EMPLOYEE training in a public utility company is detailed in the April issue of the *Executive Service Bulletin.* The primary objective of the program, put into effect by the Louisiana Power & Light Co., was to help develop supervisors as leaders and inculcate in them a keener understanding of human relations. According to the article, the results to date indicate that the efforts to do this have been very much worth while.

DOUBTLESS you have been fascinated, as we have, by the operation of multiple printing recorders but have never had the opportunity to study them closely and see exactly how they work. The type of recorder we mean prints records by numbers on a strip chart. For example, a whole row of 4's will represent flue gas temperature at the air preheater exit; a series of 5's will represent temperature of steam at the superheater outlet and so on. The very ingenious mechanism used to produce these records is described in considerable detail in an article, "Multiple Recording Printing Principles and Design," in the May-June issue of *Instrumentation.*

WATER FLOODING operations at Richfield in California brought up the oil they left behind, according to a well-illustrated and well-told story in the April issue of *On Tour.* Discovered in 1918, the Richfield field has yielded over 36,000,000 barrels of oil, but if the oil sands could be washed clean, according to the company's engineers, they could expect to produce 195,000,000 extra barrels of oil normally remaining behind when the last well had run dry. How they are doing this by injection of water into the field makes an interesting yarn.

ANNOUNCEMENT of a booklet on How and Where to Collect Social Security in April, 1946 Front Lines, page 7, brought us scores of requests for it. However, one reader, Howard J. Boyle, in asking for a copy, forgot to put his address on his letter. This is to notify Mr. Boyle that we shall be delighted to send him a copy of the Social Security book if he will kindly tell us just where to send it.

MANY AND FRANTIC were the expedients to which various industries resorted in our fair city when electric power consumption had to be curtailed recently because of the severe coal shortage here. A local envelope company has recently written to us that it is now the proud possessor of a jeep with which it can develop a portion of the power required to maintain production for its regular customers. With more good humor than some industries displayed, the letter carries a P. S. stating "Our shipment of fireflies to light up the factory is expected momentarily." Our own printers, Blakely Printing Co., purchased two new 35-kw Diesel engine generator sets from Army Surplus supplies and has already had them in operation for a time, supplying a substantial part of the power required to operate the printing plant. Some portions of *Power Plant Engineering* have been printed on presses operated by this emergency power plant; but we don't think you will be able to tell from looking at them just which pages they are. The outstanding job of meeting the emergency was, of course, carried out by Commonwealth Edison Co. in converting boilers at Fisk and Northwest Stations to oil burning, as described in the June issue.

...SMALL TURBINES ARE HARD ON OIL

THERE ARE SEVERAL WAYS to judge how hard a turbine is on lubricating oil...and size is not one of them.

When you add up unit bearing pressure... maximum bearing temperature...lube system "tightness"...times-per-hour oil is circulated ...the steam turbine serving an industrial plant is really "tough" on oil by comparison with its huge central-station brother.

With high stability toward oxidation and with positive rust-preventive properties, Shell Turbo Oils solve particularly tough problems in steel mills, mines, paper mills and processing plants. *In central stations,* Shell Turbo Oils are establishing service records unbelievable a few years ago.

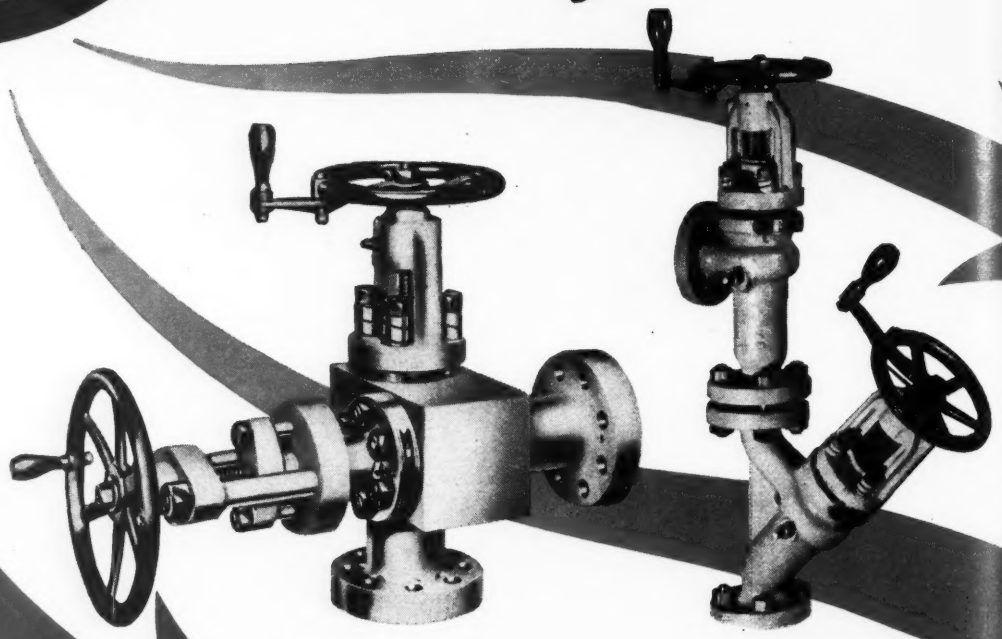
The Shell Lubrication Engineer will give you sound advice about your turbine lubricating problems.

For literature about turbine lubrication and effective turbine cleaning procedures, write to Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL TURBO OIL

3 Ways to



Yarway Unit Tandem Blow-Off Valve

Yarway Seatless Tandem Blow-Off Valve

Yarway Remote Liquid Level Indicator

YARWAY REMOTE LIQUID LEVEL INDICATOR

It's instant! It's accurate! It's convenient! This new Yarway Remote Liquid Level Indicator brings overhead gage readings right down to eye level on the instrument panel or other desirable location, on a brilliant red and green scale.

New degrees of accuracy are possible because the indicator is operated by the boiler water itself... by the pressure differential between a constant head of water and the varying head in the boiler drum. Action is instant, constant, frictionless. *There are no stuffing boxes.*

Already nearly 3,000 are in service. Write for Bulletin WG-1821.

YARWAY

GOOD BOILER ENGINEERING

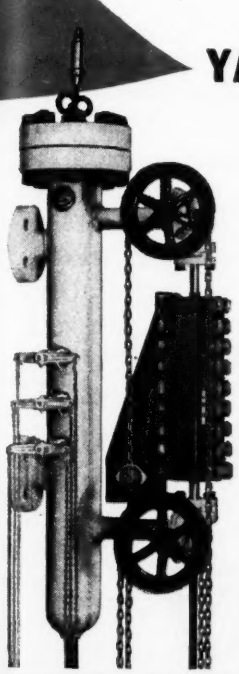
YARWAY BLOW-OFF VALVES

These are the blow-off valves that are standard in over 12,000 plants today. Yarway's famous *seatless* design eliminates one of the commonest sources of trouble and expense in boiler blow-down service. There is no seat to score, wear and clog with mud, dirt and scale. For pressures up to 2500 psi, Yarway's finest blow-off valve, the Unit Tandem, combines in a single forged-steel body a Hard-Seat* blowing valve (next to boiler) and a Seatless sealing valve.

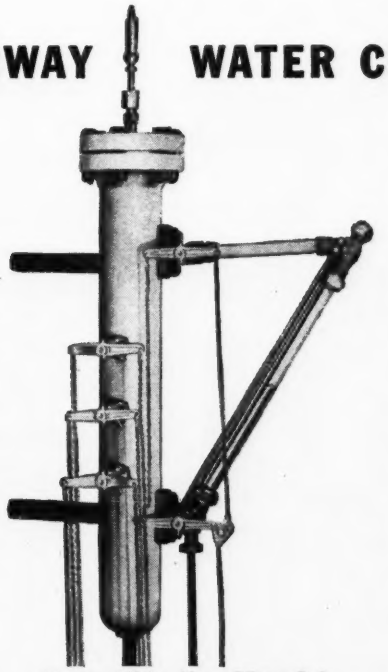
Write for Bulletin B-424 (to 400 psi), or Bulletin B-432 for higher pressures.

**Seats furnished either separate or integral.*

YARWAY WATER COLUMNS AND GAGES



Yarway Hi-Lo Alarm Water Column with Flat Glass Gage



Yarway Hi-Lo Alarm Water Column with Sesure Inclined Gage

Leading utilities, industrial plants and institutions rely on Yarway Floatless Hi-Lo Alarm Water Columns to give instant warning of any dangerous deviations in boiler water level. Alarm mechanism employs *solid weights* which operate on the displacement principle . . . can never become waterlogged. Column is furnished with Vertical or Sesure Inclined Round Glass gage for low and medium pressures . . . . or with welded Vertical Mica-protected Flat Glass gage for higher pressures.

Yarway Water Columns and Gages are fully described in Bulletin WG-1810.

YARNALL-WARING COMPANY
114 Mermaid Avenue Philadelphia 18, Pa.

STEAM PLANT EQUIPMENT

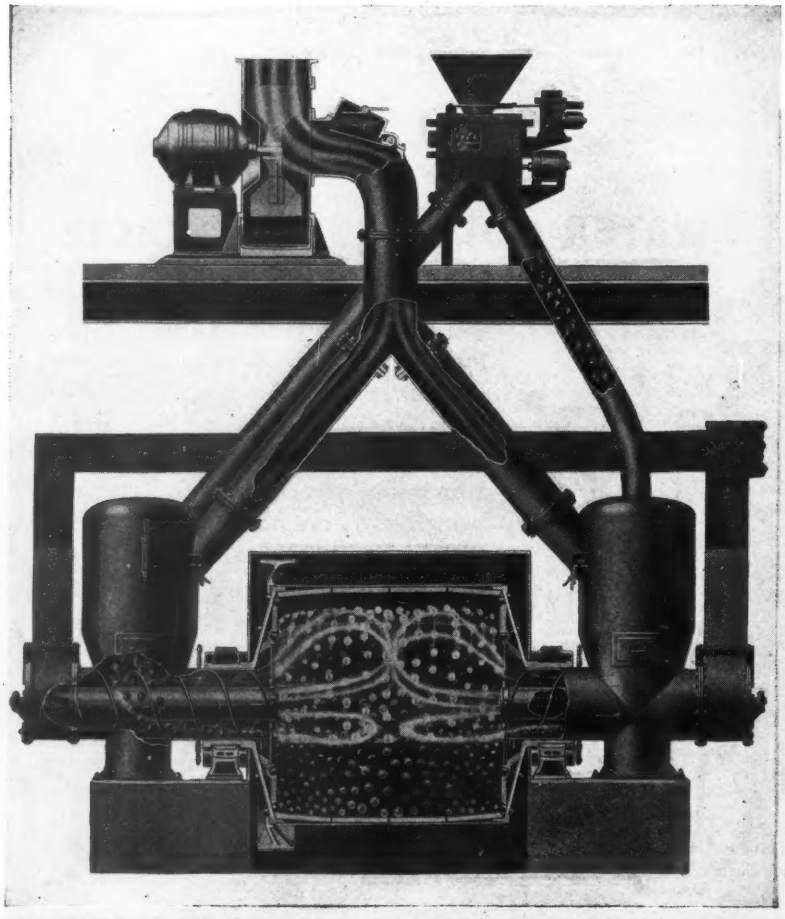
PULVERIZER MAINTENANCE COSTS

. . . AGE OF MILLS

Figures reflecting the cost of maintaining 9 Foster Wheeler ball mill pulverizers over a 13-year period reveal two interesting and important facts:

As the yearly tonnage of fuel pulverized increased, mill maintenance costs remained virtually unaffected, except...

As labor and materials costs decreased, mill maintenance costs decreased; as labor and materials costs increased, mill maintenance costs increased. ***Mill age does not appear as a factor in pulverizer maintenance costs.***

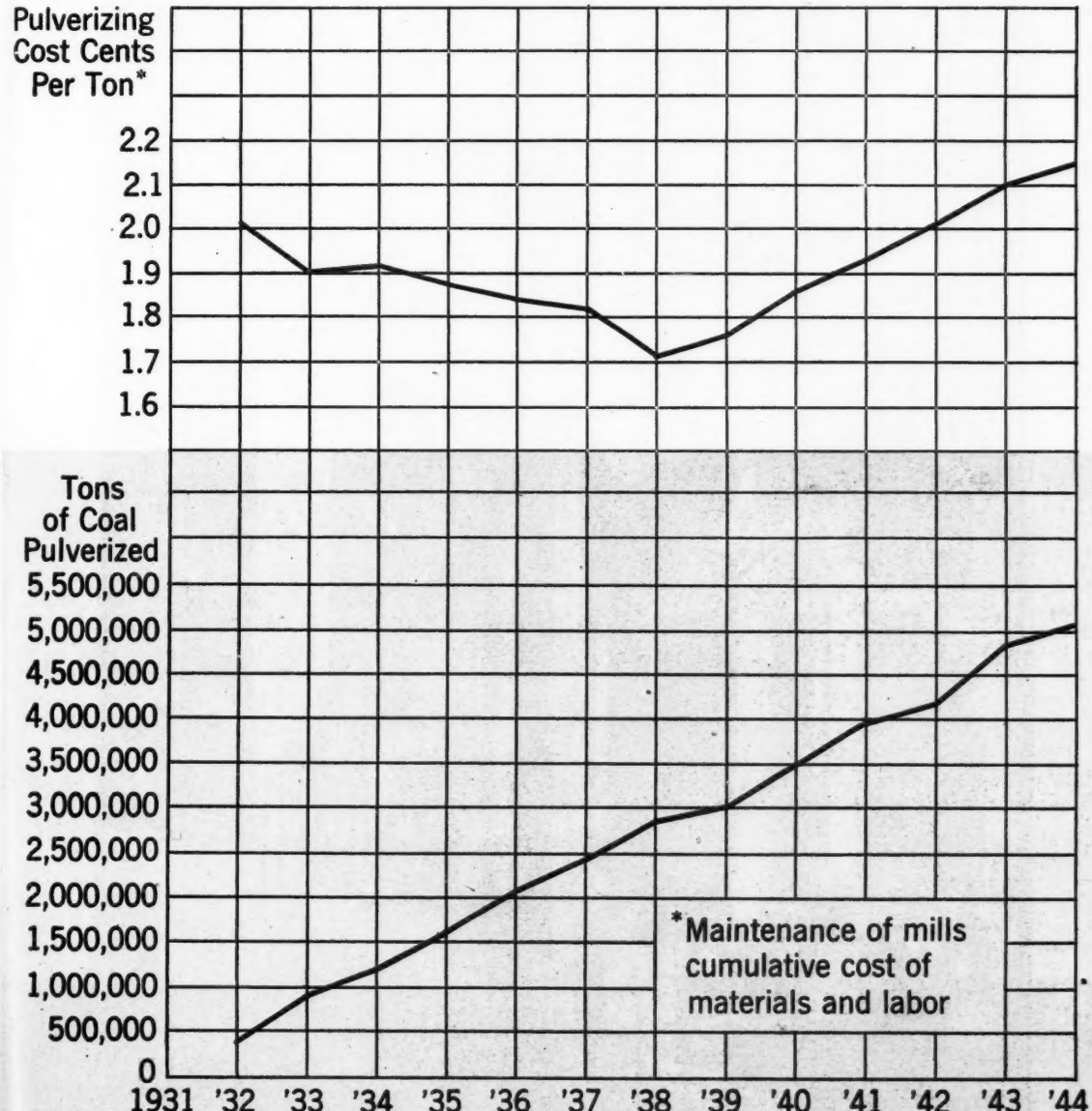


Low maintenance costs enjoyed by operators of Foster Wheeler ball mill pulverizers are only one side of dual advantages. Corollary to low maintenance is high availability—continuous service records show consistent operation with 99 percent availability. Routine inspections account for the one percent shut down—and these can be made to coincide with boiler inspections.

FOSTER WHEELER CORPORATION
165 Broadway • New York 6, N.Y.

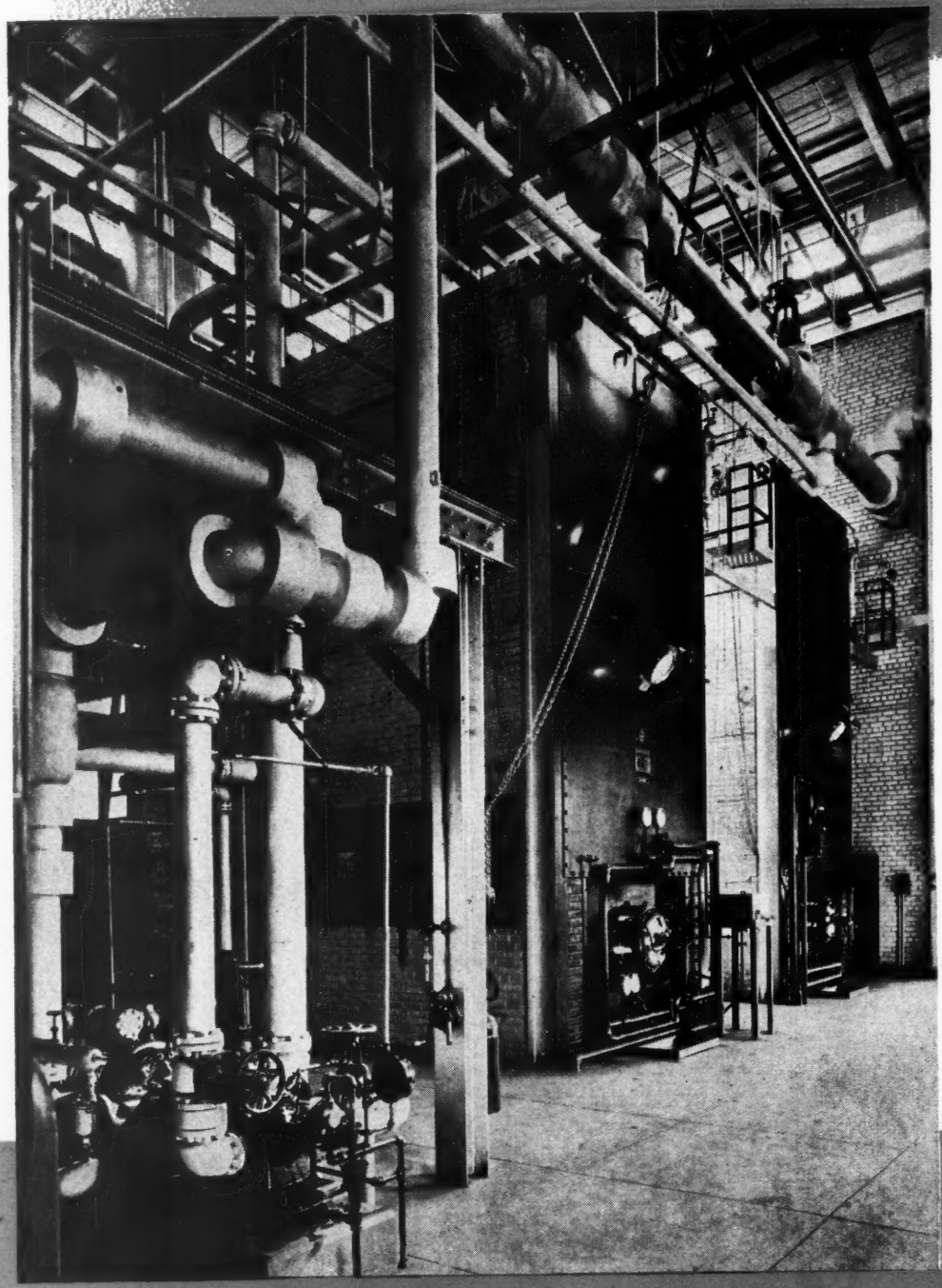
REFLECT LABOR & MATERIALS COSTS

NOT A FACTOR



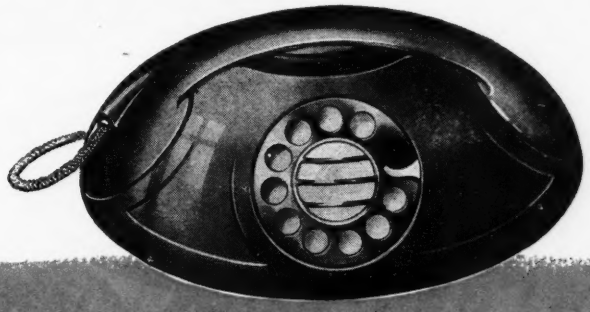
FOSTER WHEELER

STEAM for



Interior of Boiler Room at Murray Hill unit of Bell Telephone Laboratories, Inc.

Murray Hill



...ANOTHER JOB FOR B&W BOILERS

In the Murray Hill unit of Bell Telephone Laboratories, Inc., research and development organization of A. T. & T. and Western Electric, efficiency is the keynote, from the functional exteriors to the modern steam plant.

All steam for heating, and for scientific use in the unit's many laboratories, is supplied by two B&W *Design 32* Cross-Drum Boilers of the straight-tube, sectional-header type. Each of these boilers is capable of delivering 21,000 pounds of steam per hour at 125 psi and 350 F.

This B&W boiler is attractive for small and moderate capacity steam plants because of its high steaming capacity with minimum headroom and floor space requirements and its straight-tube sectional-header construction, with no pressure parts buried in brickwork. In addition, it is simple to operate and easy to inspect and clean—since the tubes are accessible from outside the boiler. It is low in maintenance expense, due to simple yet durable construction, and in total cost installed ready to put in operation.

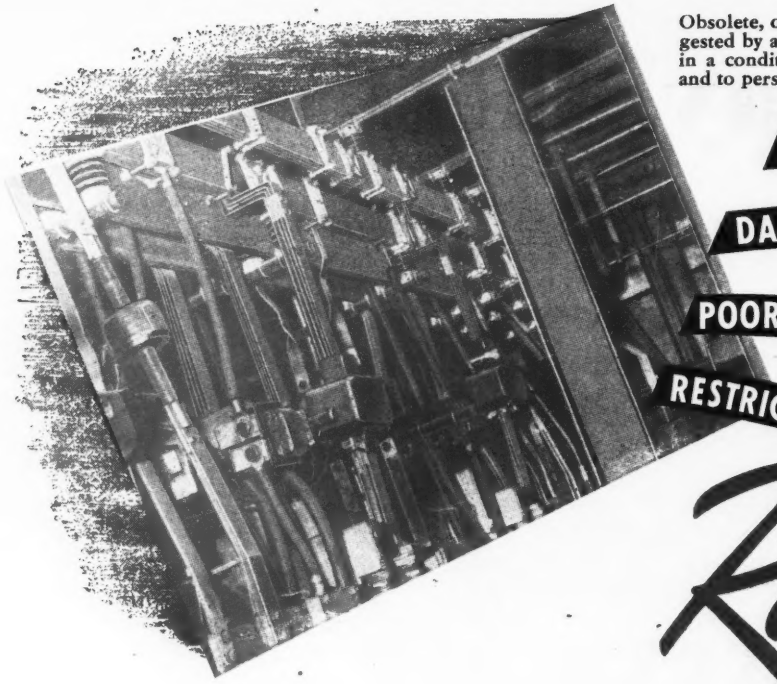
You can come to B&W for boilers to meet any steam requirements for power, heating, or processing, with assurance of getting units fitted to your needs for highest standards of performance, dependability, and overall economy. Over 60 years experience in making and applying steam-generating equipment is behind every B&W recommendation.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
85 LIBERTY STREET, NEW YORK 6, N.Y.

G-212T



Obsolete, open-type switchboard construction, congested by additions made from time to time, resulted in a condition dangerous to operating continuity and to personnel.

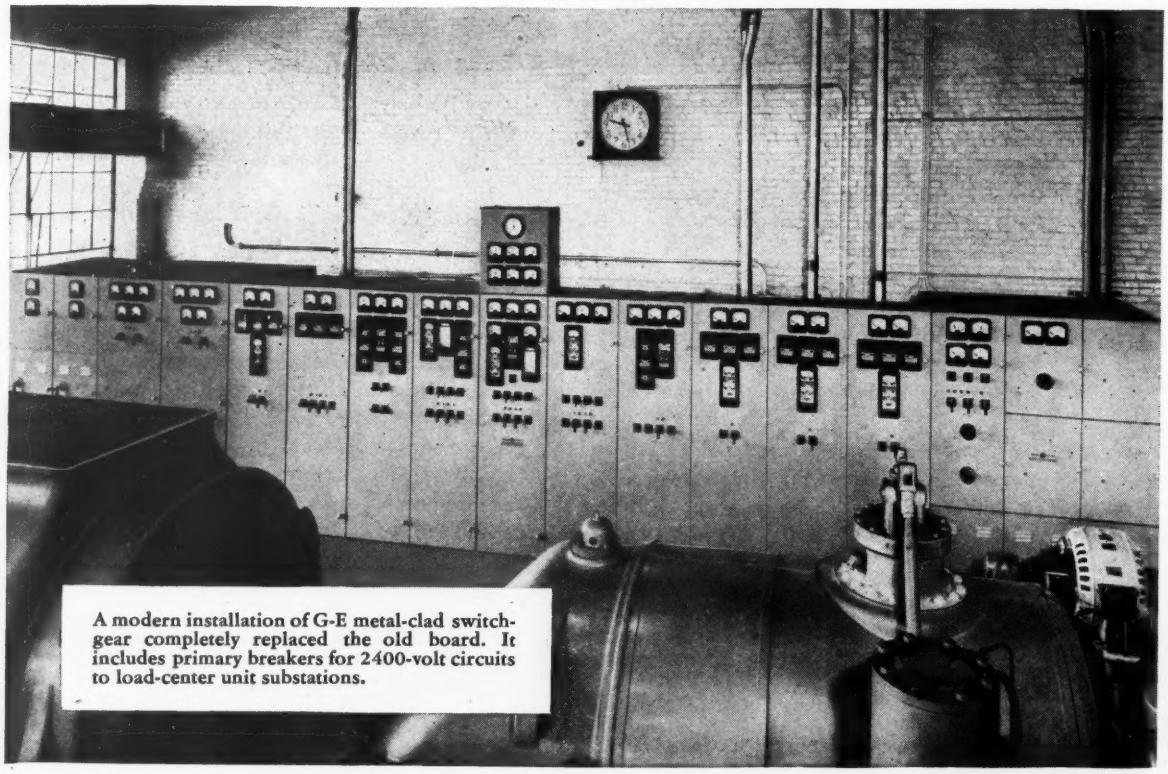
FREQUENT OUTAGES

DANGER TO PERSONNEL

POOR VOLTAGE CONDITIONS

RESTRICTIONS ON GROWTH

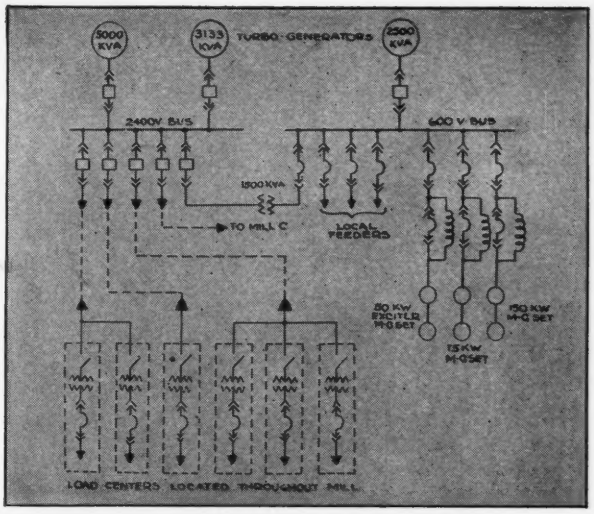
Removed



A modern installation of G-E metal-clad switchgear completely replaced the old board. It includes primary breakers for 2400-volt circuits to load-center unit substations.

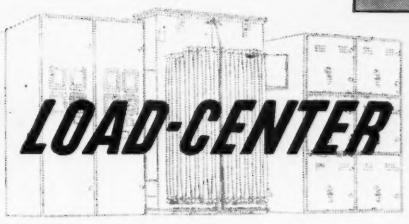
GENERAL ELECTRIC

321-45-5900



Switchgear and Load-center Unit Substations are Shown in this One-line Diagram.

Originally, the 5000-kva generator was wound for 600 volts, and all but one circuit (to mill C) was powered from the 600-volt bus. The change to 2400-volt distribution brings short-circuit amperes to a value consistent with moderate-sized circuit breakers.



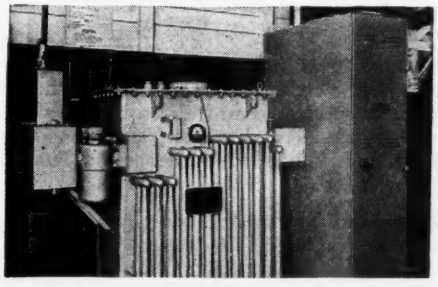
...BY G-E LOAD-CENTER UNIT SUBSTATIONS

● An old, inadequate plant power system was an open invitation to trouble at this mill. Electrical outages were delaying production. Circuits and switchgear which had been added piecemeal added to the danger of inadequate interrupting capacity. In spite of large secondary feeders, the distribution of 10,000 kva at 600 volts had created unsatisfactory voltage conditions.

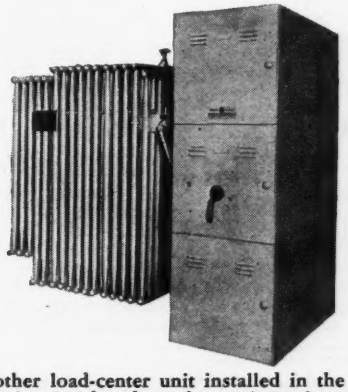
Analysis showed that further patchwork would be a costly practice. A new power distribution system, based on the use of G-E unit substations, was planned with the help of G-E engineers.

Now primary distribution is made at 2400 volts over cable that keeps voltage drop down, though it's modest in size. The powerhouse switchgear is all G-E metal-clad, equipped with magne-blast oil-less air circuit breakers. At load-center locations throughout the plant, six unit substations are installed, to step down from 2400 volts to 600. Individual circuits are fully protected by convenient metal-enclosed drawout air circuit breakers that are an integral part of the unit substation.

This new protection against outages and obsolescence is already justifying itself in power continuity and lowered costs. Why not determine, without obligation, if power-system replacement could do as much for you? Just call your local G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Typical load-center unit substation, as installed at locations which permit short low-voltage feeders to points of power use.

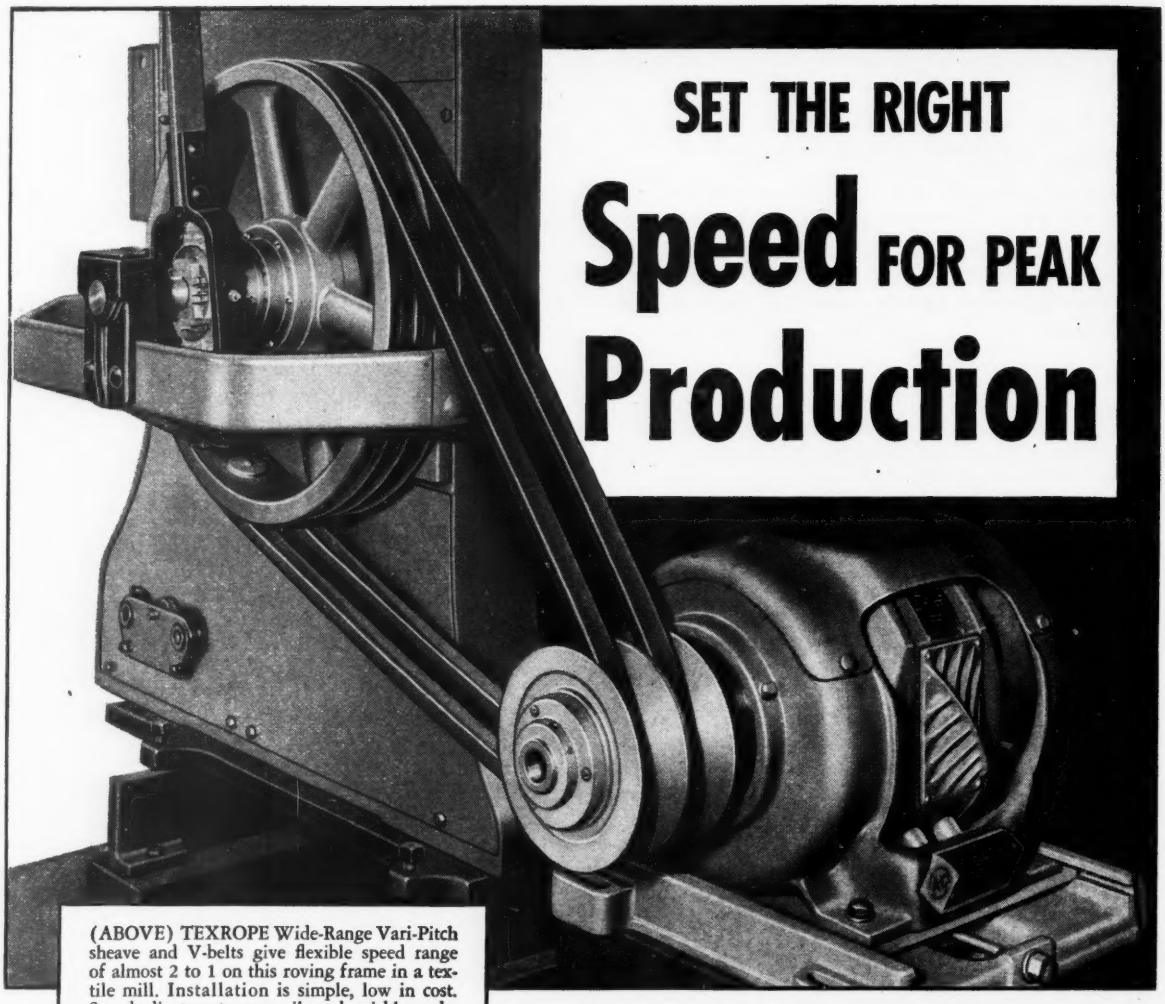


Another load-center unit installed in the mill, stepping 500-kva down from 2400 volts to 600. Draw-out air circuit breakers are co-ordinated with substation size to give full short-circuit protection without excess breaker size. Substation transformers use Pyranol non-inflammable insulating liquid.

LOAD-CENTER POWER DISTRIBUTION UNITS

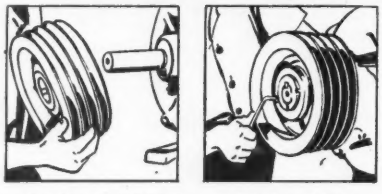
DETROIT PUBLIC LIBRARY

SET THE RIGHT Speed FOR PEAK Production



(ABOVE) TEXROPE Wide-Range Vari-Pitch sheave and V-belts give flexible speed range of almost 2 to 1 on this roving frame in a textile mill. Installation is simple, low in cost. Speed adjustments are easily and quickly made.

"MAGIC-GRIP" SHEAVE



GOES ON EASY . . . GRIPS TIGHT

Patented "Magic-Grip" sheave comes completely assembled. You simply slip it on the shaft (there's easy clearance for even over-size shafts) then tighten three cap screws. Sheave is locked on with a powerful clamp fit — yet it can be removed just as easily. No hammering to damage motor bearings — no filing or reaming. And, no wobble, weave or backlash.

TEXROPE Variable-Speed Drives Give Speed Flexibility at Low Cost

ON MILLS, machine tools, blowers, pumps — wherever changes in speed will add to operating efficiency, output or economy — get the speed flexibility you need with low-cost constant-speed motors and Texrope Variable Speed Drives. There are types to meet all requirements: Vari-Pitch sheaves, for stationary and motion control, Wide-Range Vari-Pitch drives and Speed-Changers.

COMPLETE V-BELT SERVICE: Your Allis-Chalmers dealer or district office offers TEXROPE "Super-7" V-Belts in five types, all lengths and sections; TEXSTEEL, TEXDRIVE and "Magic-Grip" Sheaves. It's a COMPLETE line of V-Belt equipment, engineered by Allis-Chalmers, originator of the multiple V-Belt Drive. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 2084

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES

Payoff inside a pulverizer!

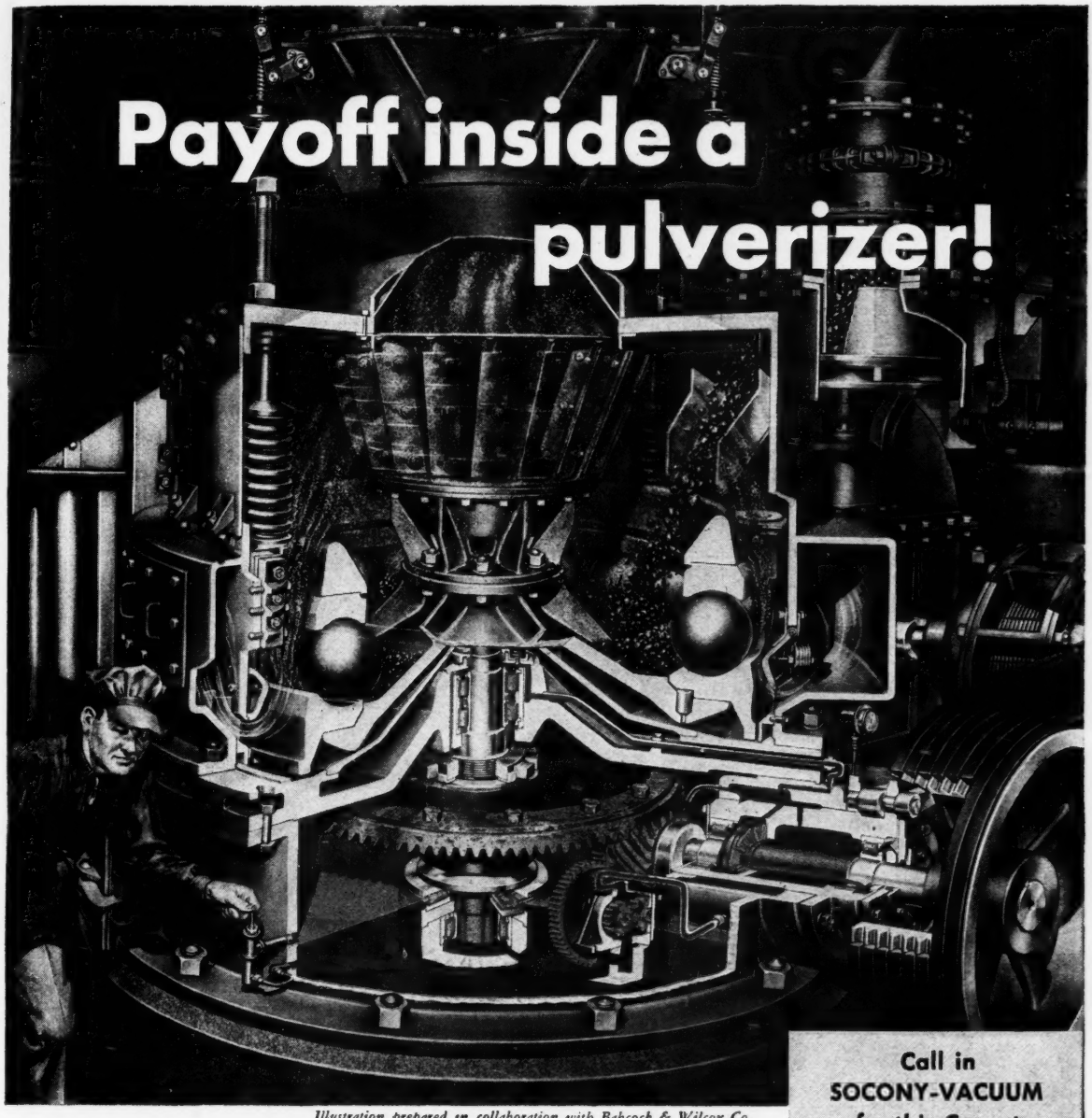


Illustration prepared in collaboration with Babcock & Wilcox Co.

FOLLOW those hefty steel balls shown grinding coal lumps to fine dust inside this big pulverizer. Imagine the loads that lubricating oil has to carry on the bearings and gears.

This is a typical example of how Correct Lubrication by Socony-Vacuum helps maintain efficient, low-cost operation. There are others in almost every machine in every industry.

Here, for example, the weight of the entire operating mechanism rests on thin films of oil under the thrust bearing at the base. Those precision-cut gears and roller bearings operate under continuous high pressures. Yet a special Gargoyle circulating oil cushions the shocks, protects against wear, stands up for long periods of service even though operating temperatures may be high due to induced heat.

The result — more continuous production, reduced maintenance and lower oil costs — the same factors that you get for *all* your machines with Socony-Vacuum's *correct* oils and greases.

Call in SOCONY-VACUUM for this Correct Lubrication Program

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

GARGOYLE Lubricants

Socony-Vacuum Oil Co., Inc.

and Affiliates: Magnolia Petroleum Co., General Petroleum Corporation

The FACTS on Boiler Water Conditioning

were not found in the textbooks

Digging up facts before they get in the textbooks is an old habit with Hall Laboratories—and it is a habit that has been of the utmost importance to every boiler plant operator.

Hall started that way twenty-four years ago, when they tossed theory aside and learned by careful experiment just what actually happens in a boiler, how scale is formed and deposited, and how it can be prevented. Today, the facts discovered at that time *are* in the textbooks, and the basic principle of the Hall system—maintenance in the boiler water of certain essential chemical equilibria—has met with practically universal acceptance.

The establishment of this principle was one of the most important steps ever taken in boiler water conditioning, but to Hall chemists it was only a starting point. Continuing their study of chemical reactions *at the temperatures and pressures encountered in steam boilers*, they brought about the use of phosphates in boiler water conditioning.

That, too, was a great step forward, and led to the creation of a new phosphate, developed from a sodium phosphate glass which had been neglected for nearly a century.

Fundamental research in factors pertaining to boiler water conditioning has been continued through the war, and it will remain an integral part of the work of Hall Laboratories. This continuous research is your assurance that they will always be ready to meet new problems created by changes in operating conditions and advances in boiler design.

Every plant that generates its own steam can profitably use Hall service, for Hall service *keeps boilers on the line.*

Write for full information.

HALL LABORATORIES, INC., HAGAN BUILDING, PITTSBURGH 30, PA.

A subsidiary of Hagan Corporation

HALL SYSTEM *of Boiler Water Conditioning*

Here's what Hall Clients get:

1. Thorough study of all factors concerning water involved in producing steam.
   Boiler temperatures, pressures and ratings, boiler design, and other factors must be taken into consideration—not merely the constituents of the feed water.

2. Procedure for the proper treatment of boiler water.
   A definite program of treatment to maintain the required chemical equilibria, plus instruction for frequency of blowdown and other matters related to proper functioning of the boiler.

3. Instruction of designated employees in making of essential control tests.
   When proper conditions have been established, they must be maintained, in spite of variations in feed water and changes in operating conditions. Any boiler operator can, after instruction, follow the simple test routine developed by Hall chemists.

4. Periodic check up by Hall service engineers.
   Experience in hundreds of plants is brought to your plant by these men, and often enables them to detect conditions that might otherwise be overlooked.

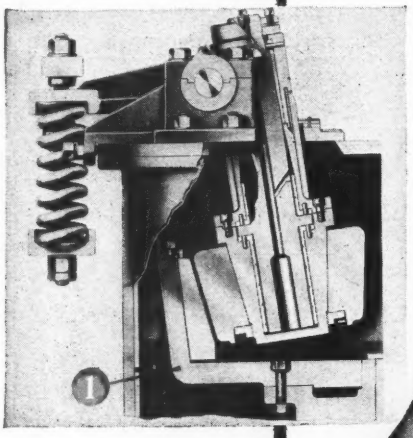
5. Periodic checking of samples by Hall Laboratories.
   This is your assurance that testing at the plant is being carried out according to instructions.

6. "Trouble shooting" as problems arise.
   If trouble does occur, Hall engineers are prepared to trace it to its source, and give all possible help in correcting it.

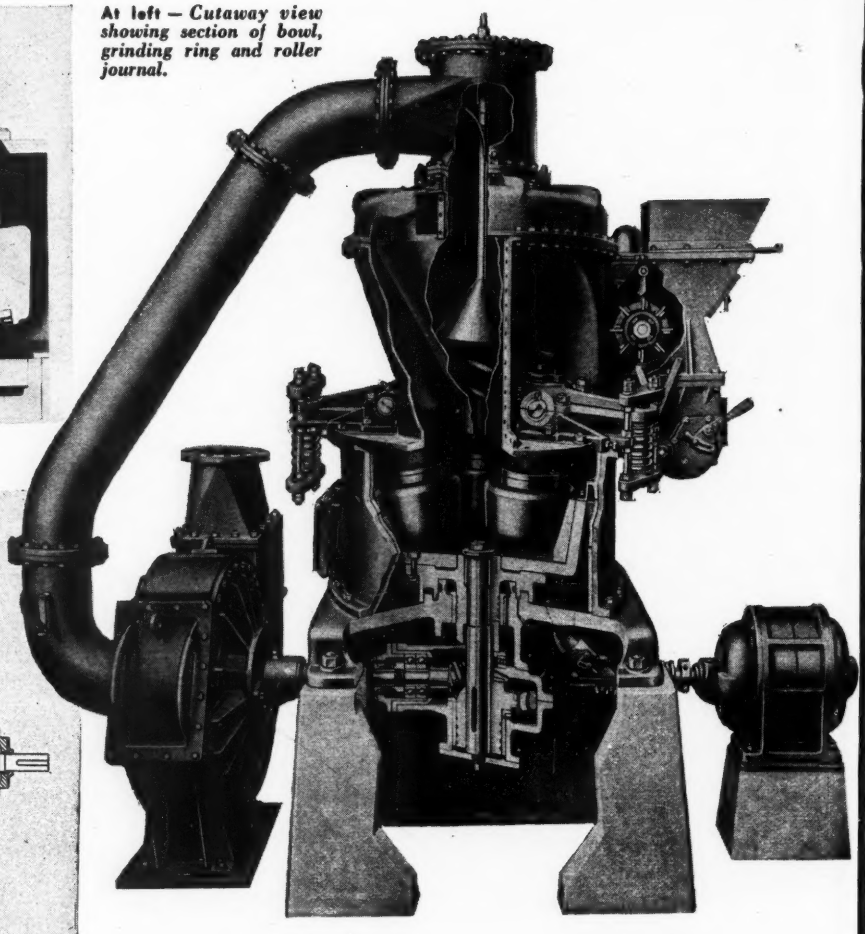
PLUS the assurance that you not only have the most effective system of boiler water conditioning yet devised, but also that new developments in this field will be available to you as soon as their value has been established under actual operating conditions.

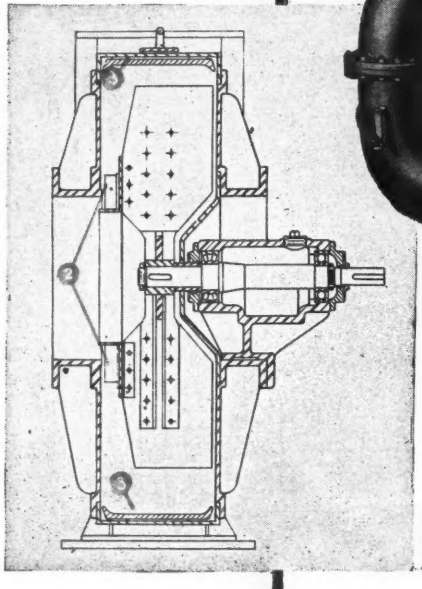
HAGAN
HALL
UROMIN
CALGON

C-E RAYMOND



At left — *Cutaway view showing section of bowl, grinding ring and roller journal.*





At left — *Section through mill exhauster showing new shrouded fan wheel with "whizzer" blades.*

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

BOWL MILL...

now better than ever

In 1935 the C-E Raymond Bowl Mill came into the steam-power field with design and operating advantages that revolutionized previous concepts of coal pulverization. It had a wide capacity range. It handled wet coal with great facility. It was rugged, accessible and easily maintained. The mill ran quietly and power consumption was low. In consequence, the Bowl Mill won immediate and widespread acceptance among plant engineers — more than a million lb pr hr of grinding capacity was ordered within five years.

Today, the Bowl Mill with all of its initial advantages, offers several new improvements, among which the following are of major importance:

1. Flat-Bottom Bowl — increases the response of the mill to load changes by eliminating any inactive area where coal can remain in the mill; also avoids any tendency of heavy, abrasive material such as pyrites, to accumulate in the bottom of the bowl.

2. The Whizzer Wheel — a new exhauster wheel design which greatly increases the life of exhauster blades. A shrouded wheel carries heavily constructed "whizzer" blades which bypass a portion of the air-coal mixture directly to the exhauster outlet. In service this has doubled the life of exhauster blades — in some cases more than doubled it.

3. New, Wear-Resisting Materials — are now being used for exhauster liners and deflectors, resulting in greatly increased life of these parts.

4. Center Feed — where conditions permit, larger Bowl Mills can now be arranged for center feed which assures a freer flow of coal to the mill and serves to equalize wear on grinding parts.

Thus 1946 finds the C-E Raymond Bowl Mill, after more than 10 years at the top of its field, still adding refinements in design and materials that make it better than ever before.

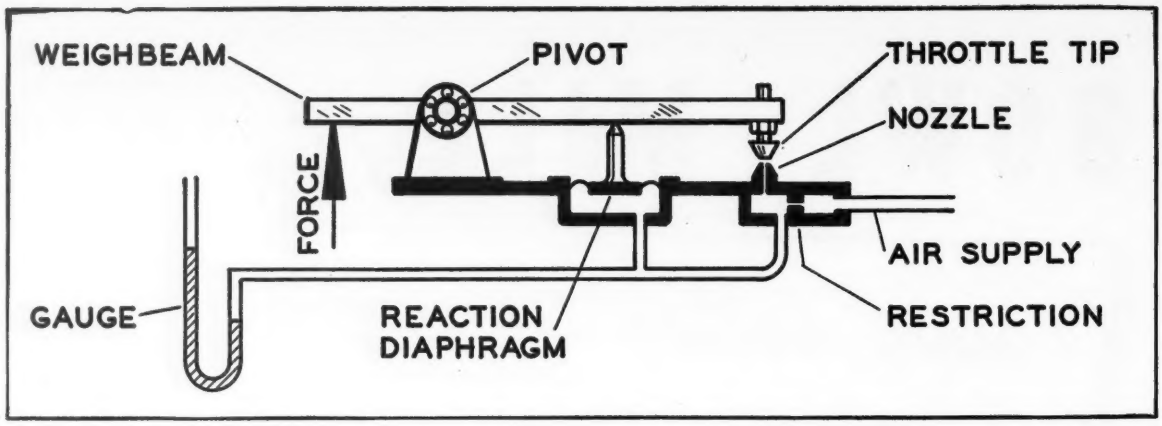
40% of all Bowl Mills purchased to date are Repeat orders

C-E

A-977

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.



The Principle of pneumatic balance transmitters

The Principle of Pneumatic Force-Balance

FOR MEASURING FLOW • PRESSURE • LEVEL • DENSITY • TORQUE

The basic principle of Republic pneumatic transmitters is illustrated above. The force developed by some condition or property of the variable is transmitted by a pivoted weighbeam to the reaction diaphragm. Compressed air, admitted through an orifice, bleeds at the nozzle, being restricted in its flow by the throttle tip mounted on the weighbeam. A very small motion of the throttle tip—less than 0.004" completely opens and closes the nozzle.

As the force produced by the process variable attempts to move the weighbeam, the throttle tip approaches the nozzle. The resulting restriction on the flow of air from the nozzle causes an increase in pressure on the upstream side of the nozzle, which is immediately transmitted to the reaction diaphragm. The force produced by the diaphragm tends to cause the weighbeam to go in the opposite direction. The result is that the throttle tip is held at just the distance from the nozzle which causes stable balance of forces.

Since the total motion of the throttle tip is less than 0.004" and the motion of the reaction diaphragm is less than this, the diaphragm does not change in effective area, and the air pressure on the reaction diaphragm is, therefore, a straight line function of the variable force. Calibration results from establishing the ratios of lever lengths, the size of the reaction diaphragm, and the desirable range of transmitted pressure values. The pressure may be conducted to a remote location by means of copper tubing, and a pressure gage connected to the tubing may be graduated directly in terms of the measured variable. The pressure may also be used as the measuring impulse for automatic regulation.

FLEXIBILITY—Range is easily changed in the field by changing the position of the reaction diaphragm along the weighbeam. If this is not sufficient, the size of the reaction diaphragm may be readily changed. In the case of pressure and differential pressure transmitters, the size of the measuring element diaphragms may also be changed readily.

EASY TO SERVICE—The cover can be completely removed so that all parts are readily accessible. All parts are of standard machine size and do not require special or watchmaker's size tools.

EXPLOSION PROOF—An inherrent characteristic of pneumatic transmission. Where electric chart drives are required in recording receiver, they can be supplied in explosion-proof housings meeting underwriter's requirements.

SMALL DISPLACEMENT—The small motion of diaphragms eliminates many troubles encountered with deflection type instruments. Most of the difficulties, encountered with liquid seals, condenser chambers and purging systems, result from the displacement of the measuring elements of deflection type instruments. The extremely small displacement of the measuring elements of Republic transmitters eliminates practically all of these troubles.

RANGE SUPPRESSION—The force balance principle permits much higher range suppression than can be done with ordinary deflection type instruments. Up to 80% of the maximum scale range of pressure and differential pressure instruments can be suppressed, while in density transmitters the amount of suppression is practically independent of the scale range.

COMPOUND RANGES—Compound ranges (plus and minus scales) can be furnished in practically any combination desired.

THE ABOVE WAS TAKEN FROM OUR DATA BOOK No. 1000 ON PNEUMATIC TRANSMISSION • WRITE FOR COPY

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

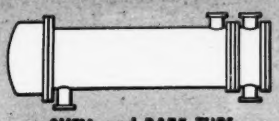
To obtain

MAXIMUM DISTILLED WATER with MINIMUM STEAM

use...

A MULTIPLE EFFECT G-R EVAPORATOR SYSTEM

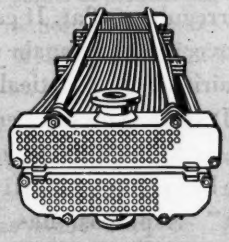
ONLY G-R BUILDS THIS WIDE VARIETY OF HEAT TRANSFER APPARATUS



SHELL and BARE TUBE
Heaters, Coolers, Condensers, Heat Exchangers

G-FIN
Longitudinal-finned elements for greater heat conductivity

K-FIN
Helical-finned elements for vapors and gases

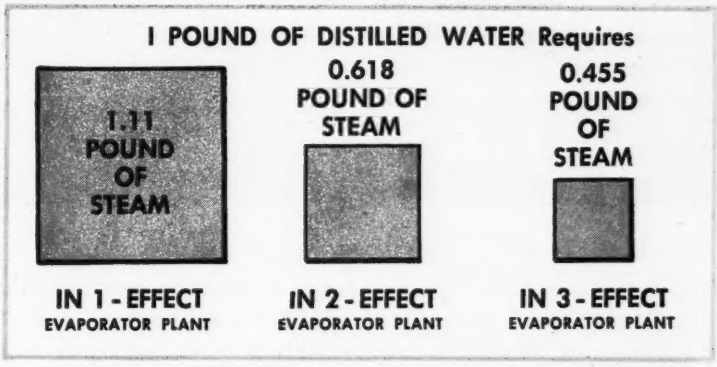


BENTUBE EVAPORATOR
Scale-shedding Elements

TUBEFLO SECTIONS
Non-clogging design for residuum and other dirty fluids

The amount of steam required to produce a pound of pure distilled water — by single effect and multiple effect evaporators — is diagrammatically shown below.

The greater thermal efficiency of a multiple effect system produces more distillate per pound of steam — a great advantage in plants requiring a large percentage of boiler feed make up with a minimum of available steam.


I POUND OF DISTILLED WATER Requires
1.11 POUND OF STEAM
0.618 POUND OF STEAM
0.455 POUND OF STEAM
IN 1 - EFFECT EVAPORATOR PLANT
IN 2 - EFFECT EVAPORATOR PLANT
IN 3 - EFFECT EVAPORATOR PLANT

A more complete explanation of multiple effect evaporator systems, and other factors involved in the decision of the most economical method of producing pure distilled water or vapor for individual plant requirements — are fully discussed in Bulletin 364 which will be sent without obligation on request.

THE GRISCOM-RUSSELL CO.
285 Madison Ave. New York 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

How to make your place of business QUIET... MORE EFFICIENT with K&M Sprayed "Limpet"* Asbestos

Applicator: Porter-Trustin Co.
Omaha, Neb.
Architect: Leo A. Daly Company

Farmers Union State Exchange Offices. This acoustically treated ceiling is covered with Sprayed "Limpet" Asbestos—notice the smooth, unbroken surface that assures maximum sound deadening efficiency.

IF YOU want to increase the efficiency of your organization, K&M Sprayed "Limpet" Asbestos sound-absorbing material holds the perfect solution.

Applied to the ceilings of your offices, laboratories, testing rooms, or other noise-ridden places, Sprayed "Limpet" Asbestos will not only muffle bothersome sounds through diaphragmatic action, but will absorb it still further through porosity. The resulting quiet atmosphere will make for better concentration, greater employee output, smoother operation and pleasanter working conditions.

Because K&M "Limpet" Asbestos is applied as a blanket-like coating by means of a special spray process, it leaves no seams, no joints, covers all surfaces whether curved, irregular or flat. It can be painted over and over again without impairing its acoustical efficiency. It is fire-proof, vermin-proof... and in addition to its sound-absorbing qualities, "Limpet" Asbestos has high thermal insulation value. Write to us for complete information on this remarkable, quiet-producing material.

K&M best in asbestos

Nature Made Asbestos..
Keasbey & Mattison
has been making it serve
mankind since 1873

*Trade Mark Reg. U. S. Pat. Off.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

ARMSTRONG *Inverted Bucket* STEAM TRAPS

BOOST PRODUCTION! By getting rid of both air and condensate in a hurry, Armstrong traps enable you to keep steam heated equipment up to peak production efficiency all the time.

CUT FUEL COSTS! Snap-action closing and opening of valve insures tight seating and stops expensive steam leakage. You get full heat value out of every pound of steam.

SAVE MANPOWER! Take advantage of Armstrong's trouble-free performance. These traps can handle all ordinary amounts of sediment, sludge, and dirt. Modern, self-cleaning design keeps them on the job without attention where ordinary traps fail.

REDUCE MAINTENANCE EXPENSE! All interior mechanism is stainless steel of the same quality as that used in Armstrong traps for 1500 lbs. pressure. All points of contact are heavily reinforced for wear. Friction is virtually eliminated in the design.

SATISFACTION GUARANTEED! Armstrong Machine Works and its representatives stand back of every Armstrong trap to guarantee complete satisfaction. We are always glad to help you solve your trapping problems.

Incorporating

the operating principle that gives you EVERYTHING you want in a steam trap:

1. Top view shows trap when first installed. Steam off. Bucket down. Valve open. Inlet at left, outlet at right.

2. When steam is turned on, water fills body. Excess water escapes through orifice until . . .

3. . . . Steam reaches trap and fills bucket, which floats and closes orifice.

4. Inflow of more condensate displaces steam in inlet to trap. Steam in the inverted bucket condenses. Bucket loses buoyancy, pulls on valve lever.

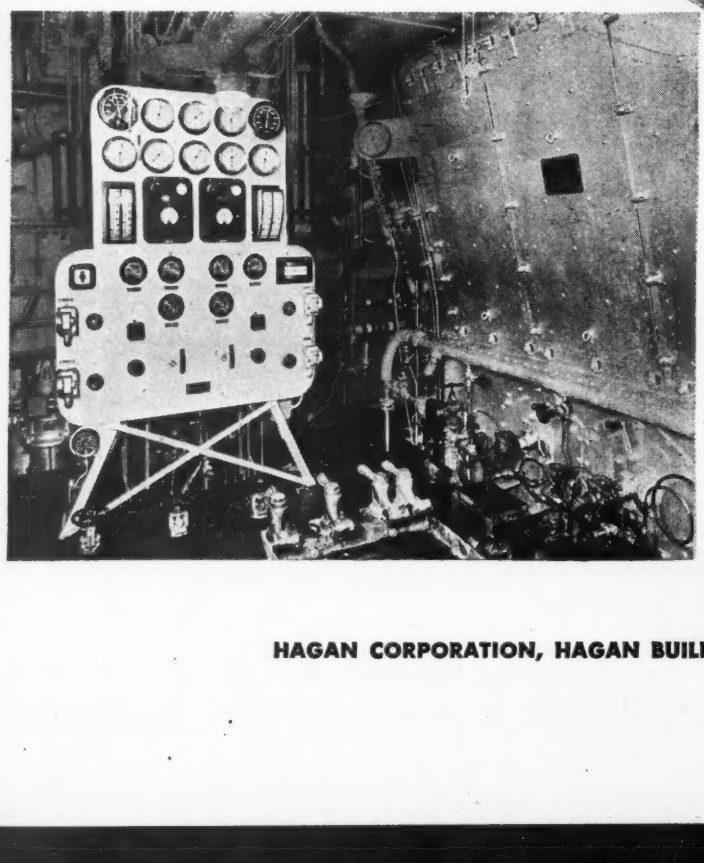
5. When weight of bucket, times leverage, equals pressure on valve, trap opens. Air, carried in with steam, passes up through small vent in top of inverted bucket and escapes through valve orifice.

Available in side inlet or bottom inlet styles

ARMSTRONG MACHINE WORKS 810 Maple St., Three Rivers, Michigan, U.S.A.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Proved



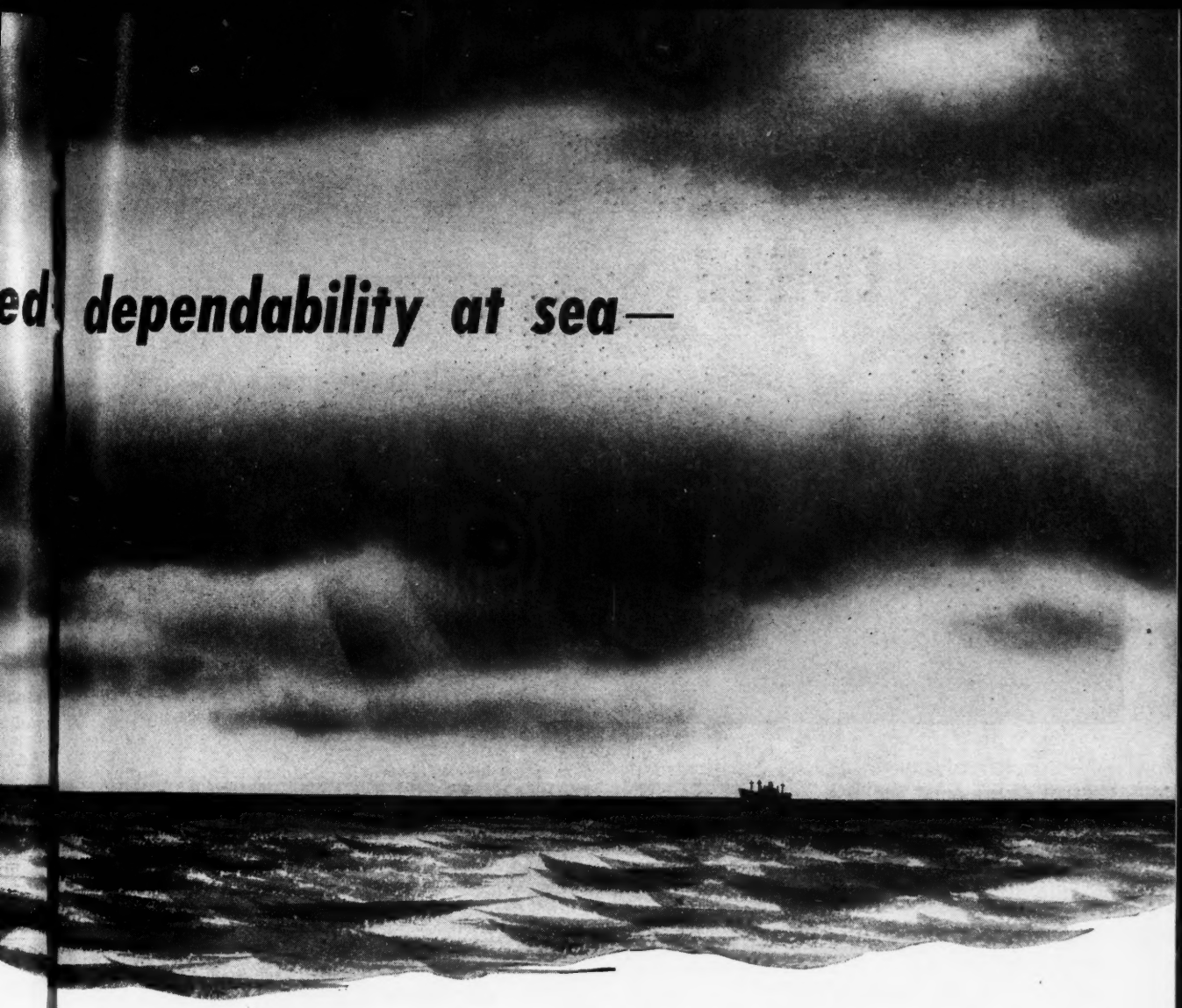
proves

Hagan Automatic Combustion Control "went to sea" ten years ago—the same control, in all essentials, as the control developed by Hagan for power plants on shore.

During the war, Hagan Control was installed on hundreds of ships, carrying war cargoes through sub-infested waters to the fighting fronts all over the world. In those ships Hagan Control saved manpower, cut down fuel consumption, eliminated tell-tale smoke—and did this day after day, in all kinds of weather, often under enemy fire. One ship, for example, was torpedoed and abandoned—

HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN
HALL
BUROMIN
CALGON



dependability at sea—

dependability on shore

but stayed afloat. When the crew returned to it twelve hours later, steam was up, and the engines were ready for an instant start.

The simplicity of design and ruggedness of construction, which keeps sea-going Hagan Control operating, with no more maintenance than any ordinary mechanic can provide, is important to every power plant operator.

It isn't a matter of life and death on shore, where a telephone call will bring a service man in a hurry. It is, however, a matter of economics. Boilers "off the line," even for a few hours, may seriously interfere with plant operation, and cause considerable loss.

Hagan Controls have set phenomenal records for continuous service because they are built on the Hagan principle that *control* and *metering* are separate functions. With Hagan Control, every instrument on the panel may be inaccurate or out of service, without disturbing the function of control to the slightest degree.

For Combustion Control that won't "let you down," specify Hagan. Our engineers are at your service.

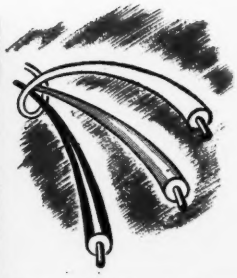
HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

FLAMENOL CABLE

for wiring that's EASY TO IDENTIFY

HARD TO HURT



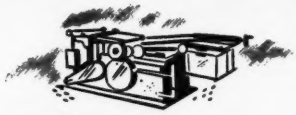
Electric circuits on machines, panelboards, control devices and the like are easily traced and identified when wired with Flamenol Cable. The smooth, impervious insulation of Flamenol *stays* bright and clean. Seven colors provide for permanent coding of complex circuits.

Once wired with Flamenol, electric circuits are well protected for the full life-span of the machine. All the usual causes of insulation damage have little if any effect on the insulation of Flamenol, as these actual cases show:

OIL WON'T HURT IT—In a chemical process plant, leads to oil-immersed motor controls were a constant source of trouble, until rewired with Flamenol. They've never given trouble since.

MILD ACIDS AND ALKALIES WON'T HURT IT—Used to wire a battery-charging set-up, Flamenol didn't fail despite "dunking" with electrolyte. In paper-mill wiring, it stood up against alkalies.

SOLVENTS WON'T HURT IT—Flamenol ended wiring troubles on printing presses where inks splashed on the wiring.



MOISTURE WON'T HURT IT—After 7 years underground in damp soil, Flamenol insulation was still impervious.

AGE WON'T HURT IT—In a seven-year test under Florida sunlight, the insulation on Flamenol cable showed no signs of deterioration.

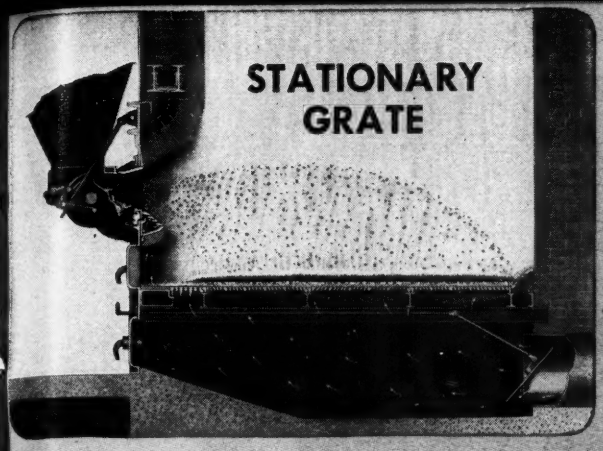
ANOTHER G-E ACHIEVEMENT RESULTING FROM "FULL-RANGE" RESEARCH

Long before the rubber shortage, G.E. had been seeking a "better-than-rubber" insulation for low-voltage wire and cable; an insulation that would be slow to age, hard to burn, and able to resist acids, oils, water, and alkalies. Soon, chemists in the G-E laboratories produced such an insulation from plasticized polyvinyl chloride. G-E process engineers then took the new insulation, and prior to 1936 had solved the problem of its application to a conductor on a practical basis. The result was Flamenol, the first wire and cable to be insulated with long-lived, tough, plasticized polyvinyl chloride—another G-E first. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

502-58-1200

A GREAT STOKER



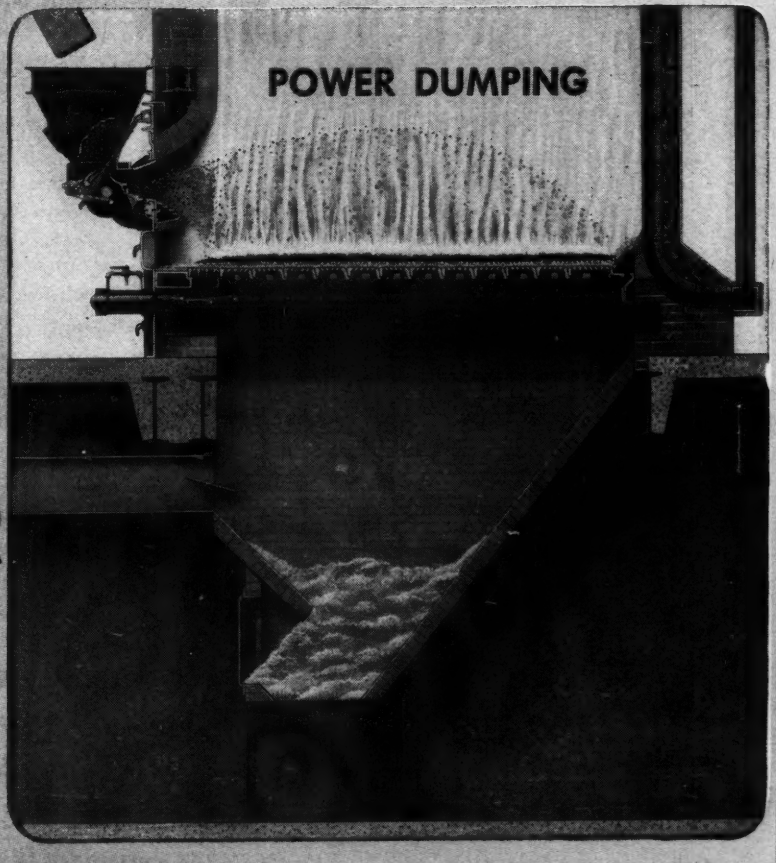
- OVERTHROW ROTORS ASSURE CONTINUOUS AND DEPENDABLE FUEL FEED AND UNIFORM DISTRIBUTION.
- BURNS ALL GRADES OF BITUMINOUS COAL WITHOUT SPECIAL PREPARATION.

DETROIT ROTOSTOKER

For SMALL to MEDIUM Size BOILERS

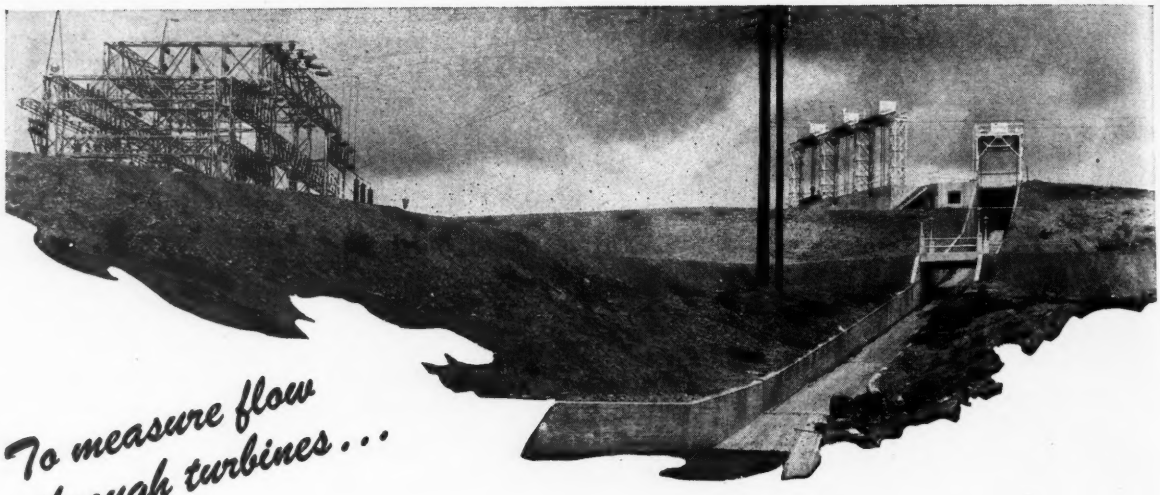
- STATIONARY
- HAND DUMPING
- POWER DUMPING

GRATES



DETROIT STOKER COMPANY

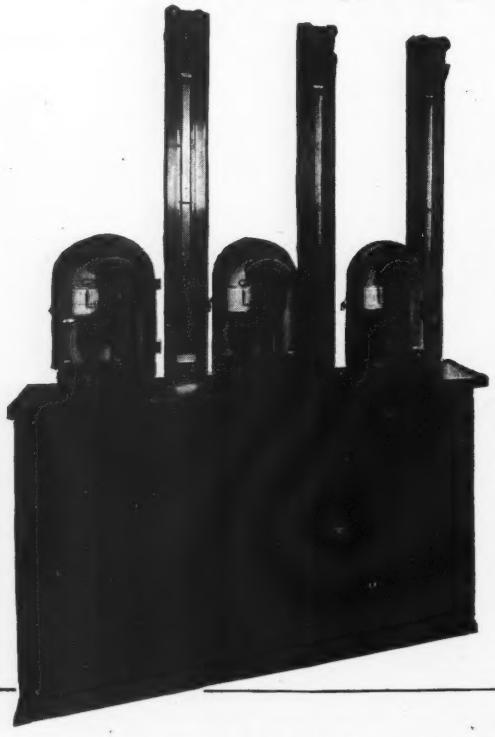
SALES and ENGINEERING OFFICES
GENERAL MOTORS BUILDING
DETROIT 2, MICHIGAN
WORKS AT MONROE, MICHIGAN



To measure flow through turbines . . .

Hydro plants the world over use the SIMPLEX W-K PRINCIPLE

IN the United States, Canada, South America and in Russia, hydro turbines depend on the Simplex W-K principle for flow measurement. By using the turbine scroll casing as a primary device in conjunction with the Simplex Type MO Meter Register, the Simplex W-K principle makes it possible to indicate and continuously record and totalize the discharge rate of the water through each turbine unit.



W-K taps placed on the turbine casings at the time of erection, or installed without difficulty on existing operations, provide an accurate measurement of turbine flow.

The flow rate data thus derived aids materially in the determination of total plant operating efficiency. Flow rates are easily compared with kilowatt loading; total water horse power and water input may be compared with electric output; check tests are available at any time without alteration of conditions or equipment.

This is another Simplex "First" — and hundreds of hydro plants all over the world are benefiting by the use of the Simplex W-K principle on turbines of various capacities.

Write today for full information on the advantages of adding water flow rate facts to your working essentials.

SIMPLEX VALVE & METER COMPANY

6783 UPLAND STREET, PHILADELPHIA 42, PA.

Remember this Fact—Wet Coal Won't Clog This Stoker!

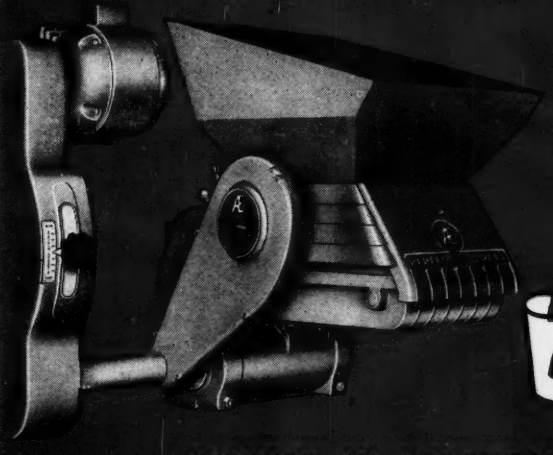
Of all the features, of all the extra advantages of the Perfect Spread Stoker this ONE is outstanding. Yes, we repeat—*wet coal won't clog this stoker!* Fill the hopper with the lowest grade coal available—wet, partially frozen or dry—and you get *continuous* feeding for the most efficient production of steam at the lowest cost.

When you check its other features, when you see its simplicity of design, when you notice its almost silent operation you'll understand why today's Perfect Spread Stoker is a *must* for today's boiler room—and for many years to come.

Get the details! Write for the completely descriptive folder!

Æ

PERFECT SPREAD STOKER



—with stationary grates, dumping grates or continuous ash discharge—up to 400,000 lbs. of steam per hour.

Won't Clog on Wet Coal!

PROVED IN PERFORMANCE FOR 17 YEARS

Today's Perfect Spread Stoker provides significant improvements to a product with a 17 year record of successful performance in 15 industries. Investigate this improved Perfect Spread Stoker.

Other Æ Products: Æ Taylor Stokers, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power

AMERICAN ENGINEERING COMPANY

2408 ARAMINGO AVENUE, PHILADELPHIA 25, PENNSYLVANIA

OXYGEN-FREE WATER FOR A MODERN BREWERY'S BOILERS

In the John Hohenadel Brewery Inc., at East Falls of the Schuylkill River in Philadelphia, feedwater for the 1,000-hp boiler load is deaerated for removal of dissolved oxygen and other corrosive gases in a 32,000-lb/hr Cochrane Deaerator. Additional storage for returned condensate is provided by the horizontal storage tank with 90 cu. ft. capacity. Both condensate and zeolite-softened makeup are deaerated.

Makeup water is city water taken from the Schuylkill River with hardness averaging 10 grains per gallon and softened in a double-unit high exchange greensand zeolite softener. Each unit of the softener can handle the entire boiler load with 24 hours between regenerations. During normal operation the two units function in parallel.

COCHRANE CORPORATION • 3123 NORTH 17th STREET • PHILADELPHIA 32, PA.

COCHRANE
SINCE 1863
DEAERATORS

Four-foot double-unit Cochrane Zeolite Water Softener.

Three foot diameter Cochrane Deaerator mounted on horizontal storage tank.

Here's how to get best results from

NONPAREIL HD
DIESEL OIL

DIESEL OPERATORS have had such excellent results with heavy duty oils that some operators have concluded these oils will stand up under any and all conditions. These oils certainly will stand up under severe use and a certain amount of abuse. But it doesn't pay to go too far in the matter of abuse.

You can get longer engine and oil life, lower maintenance and replacement costs by using Nonpareil HD Diesel Oil and by observing the few precautions listed here. A Standard Oil Lubrication Engineer will help you test Nonpareil HD and take full advantage of its clean, wear-reducing operation. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

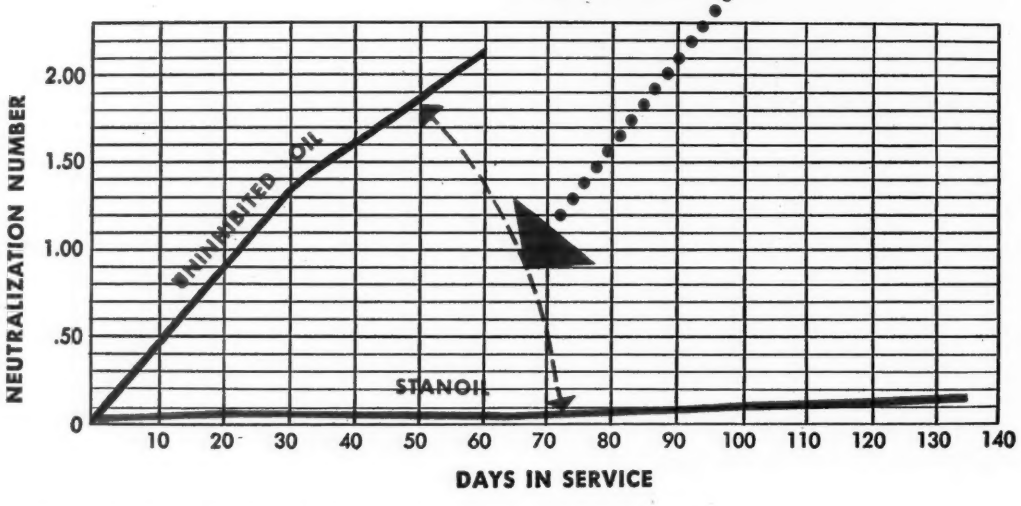
Don't remove additives by severe filtration. Best results cannot be obtained from Nonpareil HD, or other truly heavy-duty oils, when adsorbent type filters are used. Fuller's earth or similar clay-type filter materials soon clog. They also tend to remove the additives which give heavy-duty oils their superior detergent and oxidation inhibiting properties. But filter manufacturers can supply you with filter materials which will clean Nonpareil HD Diesel Oil without premature clogging or excessive additive loss.

Don't attempt to restore color to used oil. Heavy-duty oils darken rapidly in service and cannot be satisfactorily restored to their original color. Detergent oils possess the ability to carry in suspension very fine particles which cannot be completely removed by filtering. The particles which remain in the oil after filtering are microscopic, and do not impair performance of the oil. Normal make-up oil, plus proper filtering, will maintain effective detergency in Nonpareil HD for long periods of time.

Don't overheat oil during filtration. In an effort to speed up filtration, high filter operating temperatures—as much as 350°F. to 400°F.—are sometimes used, particularly with clay-type units. Regardless of whether heavy-duty or the older type oils are being filtered, excessive temperature is harmful to Diesel Oil. It results in high filtration losses, oil oxidation, and impaired oil stability.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Here's the difference between uninhibited oils and Improved STANOIL



Oil lasts longer in gear cases . . . in bearings . . . in compressors . . . and hydraulic systems

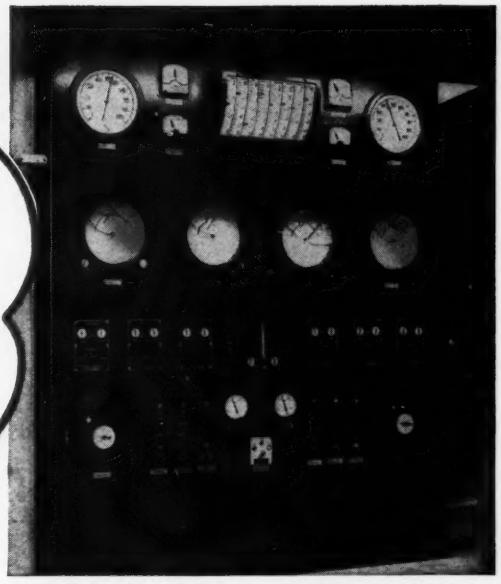
THE CHART above shows the operating record of two oils in a speed reducer on an induced draft fan. Operating conditions were severe, as the fan ran 24 hours a day—so severe that a straight, uninhibited oil lasted only 60 days before acidity reached 2.15 mg.KOH/gm and the oil had to be replaced.

This was one spot chosen to test Improved STANOIL—a high quality mineral oil to which an oxidation inhibitor is added. The second curve shows the results. After 135 days of operation the neutralization number of the oil did not go over 0.15.

Deposits, corrosion and acidity caused by oil oxidation have been reduced in service tests on all types of equipment. A Standard Oil Lubrication Engineer will be glad to give you further information on Improved STANOIL and suggest installations in your plant where this oil can save machine down-time, oil replacements and wear. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

TIPS ON HOW TO SELECT BOILER CONTROL



Bailey Boiler Control Panel for a 300,000 lb. per hour pulverized coal fired boiler. Both combustion and three-element feed water controls are based on accurate measurements made by meters located on this control panel.

1 Profit From the Experience of Others

It is likely that plants of the type you are considering are being already operated at optimum performance by Bailey Boiler Control. When you select Bailey Controls, you profit from this experience and get the benefit of the latest refinements in application. Over 8,000 boiler units have been equipped with Bailey Controls during the past 10 years. These units range from 3,000 to 1,000,000 lb. per hour capacity and operate at pressures from 75 to 2500 psi. They are fired by pulverized coal, stokers, oil, gas, mixed fuels and waste fuels.

2 Call In Qualified Engineers

Bailey Engineers are qualified by training and experience to consult with you on both the theoretical and practical aspects of your boiler control problems. These specialists in combustion, measurement, and automatic controls are conveniently located in over 30 industrial areas throughout the United States and Canada. Your local Bailey Engineer stands ready and willing to apply the Company's know-how to your plant.

3 Specify a Dependable System

Records indicate that compressed air is a reliable operating medium. Unlike electricity or oil, it continues effective for a time after power failure.

Bailey Boiler Controls are sturdy air-operated units which function in accordance with accurate measurements made by Bailey Meters.

4 Avoid Make-Shift Applications

The wide selection of both measuring and controlling elements offered by Bailey Meter Company provides complete flexibility of control application. The correct combination of these elements does a thorough job without excessive equipment.

5 Insure Smooth Operation

Coordination of related control systems such as combustion, feed water, steam temperature, and condensate flow insures against costly disturbances in plant operation. Proper coordination improves control action, increases safety of operation, reduces auxiliary power required and reduces storage capacity needed in heaters and boiler drums.

6 Be Sure You Can Get Service

Users of Bailey Control have but to call on the nearest branch office of Bailey Meter Company to secure the services of a trained engineer.

For Your Plant

If you want details write for a copy of Bulletin 15-D, or ask a Bailey Engineer to call.

BAILEY METER COMPANY

1040 IVANHOE ROAD • • • CLEVELAND 10, OHIO

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

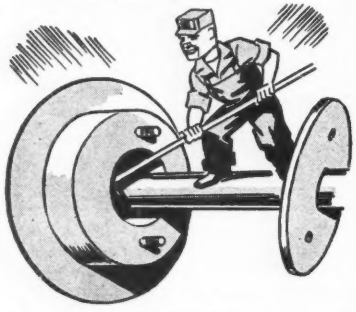
A97-1

The Stuffing Box

TIPS ON GOOD PACKING PRACTICE

NO. 2 OF A SERIES

The first step to getting the most out of packing is correct installation. Here are a few good packing practices:

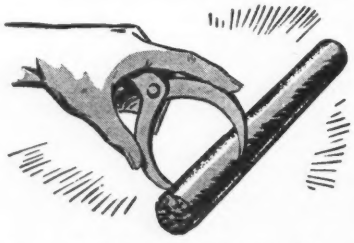


Old and new packing don't mix . . . so **First,** clean the box thoroughly by removing all the old packing, including the accumulation from the walls.

Second, be sure to keep the packing clean during application. Many rods, shafts, sleeves, etc., are scored by grit or other foreign matter picked up by the packing before installation.

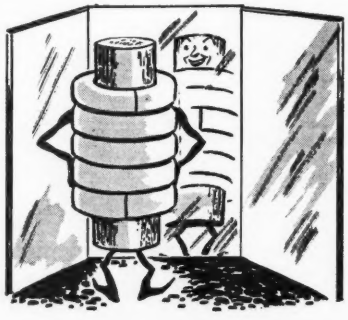
Third, of course, use all new packing when renewing. Worn packings are dry, highly compressed, have high friction and may score. Packing is much cheaper than new shafts, sleeves and rods.

How do you decide what size packing you need? The quickest and surest way is to check the diameter of rod or shaft and the inside diameter of the stuffing

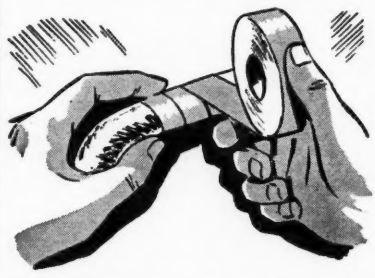


box, and choose correct size packing to fit. In this way the packing will compensate for any wear on the rod.

To get close-fitting rings . . . and save time . . . the packing should be tightly spiraled in a very close spiral directly on a rod or mandrel of the same diameter as the one on which the packing is to be used. Then place a straightedge across the packing parallel to the axis of the rod, and carefully mark or scribe the packing. The packing may then be removed from the rod or mandrel and cut on a flat surface at the places marked.



When rings are cut from soft coil stock, the ends may tend to squash or become ragged. By simply applying a small piece of friction tape around the section where the packing is to be cut, you can obtain sharp, clean cuts. Then remove the tape when installing the rings. String also



serves well for tying the packing on each side of where the cut is to be made.

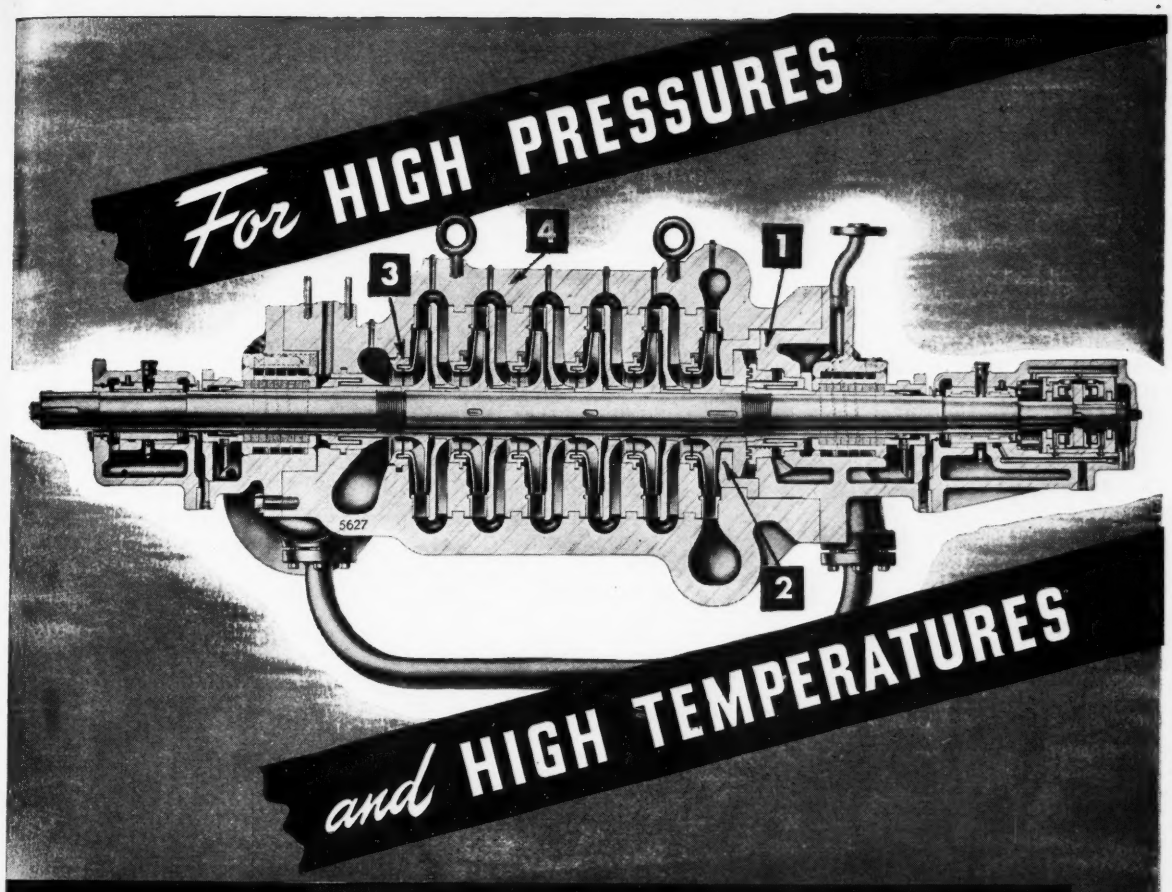
And a don't: never wind a length of packing into a stuffing box . . . cut the packing into individual rings first.

When you need a packing—there are 400 conveniently located Johns-Manville Distributors ready to supply you with the right one for your job.

a tip on a good packing . . .

JOHNS-MANVILLE MOGUL PACKING

For general utility service, choose Mogul Rod and Valve Stem Packing. Unusually adaptable, it remains permanently soft and resilient when subjected to the sustained heat of the stuffing box. J-M Mogul assures long, economical service when used on valve stems and reciprocating rods with small packing spaces . . . against air, water, ammonia, oil, chemicals and other conditions where a soft, pliable packing without rubber is needed. See your distributor, write Johns-Manville, Box 290, New York 16, N. Y.



DE LAVAL MULTI-STAGE PUMPS

1 **SOLID END-HEAD** prevents leakage around stationary balancing disc.

2 **AUTOMATIC HYDRAULIC BALANCING** leaves no unbalanced thrust to be taken up by thrust bearings or other metallic contacts subject to wear.

3 **LABYRINTH WEARING RINGS** minimize leakage from discharge to suction without requiring close mechanical clearances.

4 **CASINGS AND IMPELLERS** built of materials carefully selected to endure the particular service for which the pump is intended.

MP-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA • VANCOUVER • WASHINGTON, D.C. • WINNIPEG

These Inconel properties can help you solve many HIGH TEMPERATURE problems

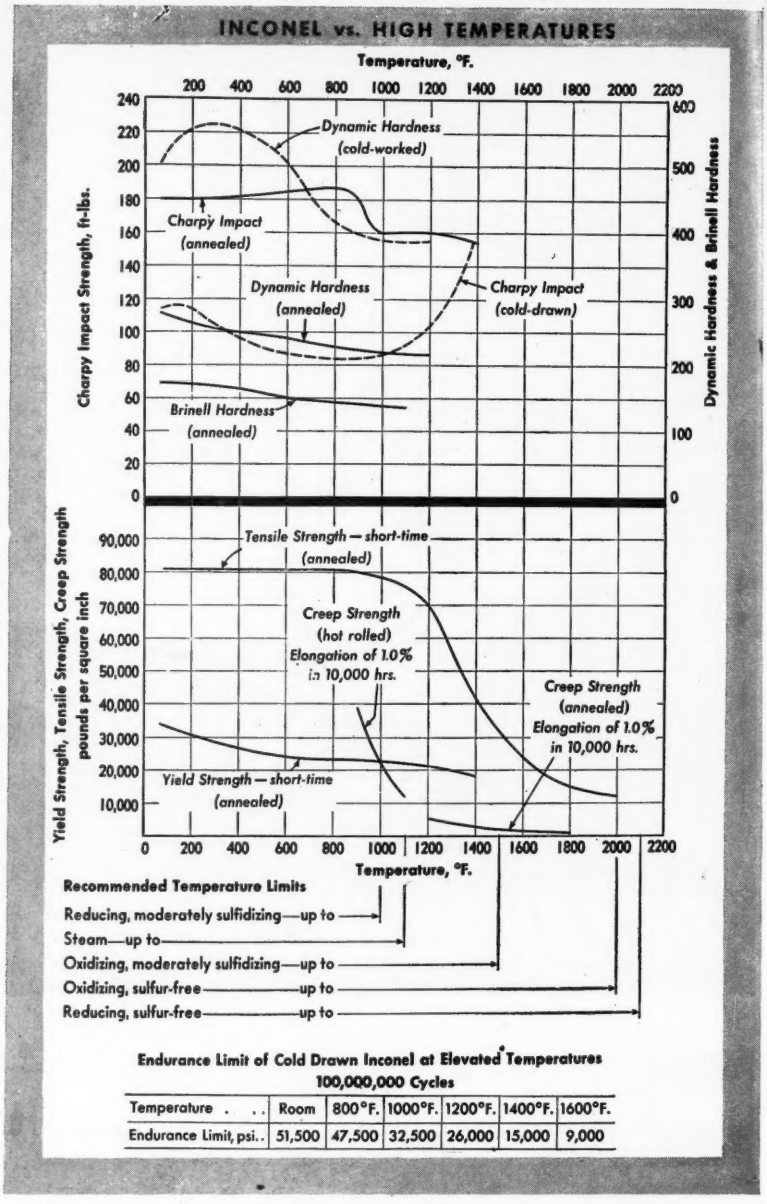
To stand high temperatures, a metal must have:

1. **Good resistance to oxidation**
2. **Good mechanical properties at high temperatures**

Alone, neither one of these properties amounts to much. If cross-sections are rapidly reduced by the scaling away of oxidized layers, high strength is of little value. On the other hand, if the material becomes too soft and weak at operating temperatures to support the designed load, then freedom from scaling goes for naught.

The only way to get the long life you're after, is to specify a metal possessing *both* properties.

In Inconel you have both!


INCONEL vs. HIGH TEMPERATURES
Temperature, °F.
200 400 600 800 1000 1200 1400 1600 1800 2000 2200
Charpy Impact Strength, ft-lbs.
Dynamic Hardness & Brinell Hardness
Dynamic Hardness (cold-worked)
Charpy Impact (annealed)
Dynamic Hardness (annealed)
Charpy Impact (cold-drawn)
Brinell Hardness (annealed)
Yield Strength, Tensile Strength, Creep Strength pounds per square inch
Tensile Strength — short-time (annealed)
Creep Strength (hot rolled) Elongation of 1.0% in 10,000 hrs.
Creep Strength (annealed) Elongation of 1.0% in 10,000 hrs.
Yield Strength — short-time (annealed)
Temperature, °F.
Recommended Temperature Limits
Reducing, moderately sulfidizing—up to
Steam—up to
Oxidizing, moderately sulfidizing—up to
Oxidizing, sulfur-free—up to
Reducing, sulfur-free—up to

Endurance Limit of Cold Drawn Inconel at Elevated Temperatures
100,000,000 Cycles

Temperature . . .	Room	800°F.	1000°F.	1200°F.	1400°F.	1600°F.
Endurance Limit, psi. .	51,500	47,500	32,500	26,000	15,000	9,000

An 80 per cent nickel—14 per cent chromium alloy, Inconel ideally combines the thermal durability of these two elements.

Inconel resists scaling and intercrystalline attack; shows high tensile strength, creep strength, impact strength, endurance limit and hardness at elevated temperatures. The charts above show why Inconel has set so many service records.

Remember Inconel wherever you have to fight Heat! Among power plant uses are packing, springs, special gaskets, refractory bolts, ash screens, thermocouple protection tubes, valve parts, instruments and the like.

For more information on the mechanical properties of metals, write for:
"THE TECHNICAL EDITOR SPEAKS."

NICKEL (INCO) ALLOYS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK 5, N. Y.
MONEL* · "K" MONEL* · "R" MONEL* · "KR" MONEL* · "S" MONEL* · INCONEL* · NICKEL · "L" NICKEL* · "Z" NICKEL*
*Reg. U. S. Pat. Off.

A WORLD OF EXPERIENCE

BACK OF *Dearborn* WATER TREATMENT AND ENGINEERING SERVICE > > >

The vast experience of the Dearborn organization is available to you in all phases of feedwater correction. Sound knowledge of desirable boiler water characteristics, gained through decades of practical experience, built Dearborn leadership. Continuous laboratory research keeps that leadership alert, ready to produce results no matter how new the problem. It is the responsibility of the Dearborn Engineer to make an individual analysis of your operating conditions and water supply —and then maintain follow-up service to assure best operating results.

Because the Dearborn Engineer lives in the district where he works he is available to give you quick service. Write to us about any boiler water troubles on which you need assistance.

Dearborn

TRADE MARK REGISTERED

THE *LEADER* FOR OVER HALF A CENTURY

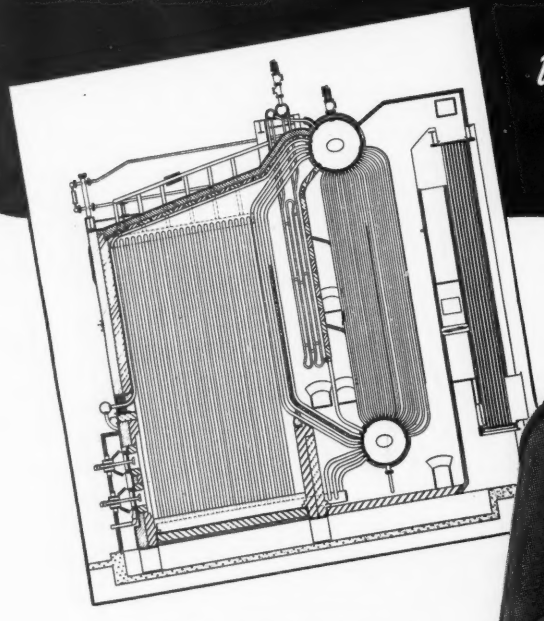
ENGINEERING SERVICE AND WATER TREATMENT

DEARBORN CHEMICAL COMPANY

Dept. F, 310 S. Michigan Ave., Chicago 4, Ill.

ROTO TUBE CLEANERS

for EDGE MOOR *Vertical Flow* Bent Tube Boilers



Edge Moor Vertical Flow Unit with Edge Moor Superheater and Air Preheater arranged for liquid fuel firing.

Leading boiler manufacturers have furnished Roto Tube Cleaners as standard equipment for over 35 years. Some of the original cleaners are still giving good service. Whatever your requirements, our experience gained by long specialization in tube cleaners assures you of satisfactory service.

Illustrated here are an Edge Moor Vertical Flow Bent Tube Boiler and the Roto Tube Cleaners which we specify for this unit. We can ship these and many other types and sizes of tube cleaners immediately from stock. Write, wire or phone.

ROTO TUBE CLEANER SPECIFICATIONS

(Above) Roto Model 226 Air-driven Motor with 478-K pivot head for 2" rear bank boiler tubes.

(At left) Roto Model 130 Air-driven Motor with S-50 swing-frame head for 3¼" water wall tubes and front bank of boiler tubes.

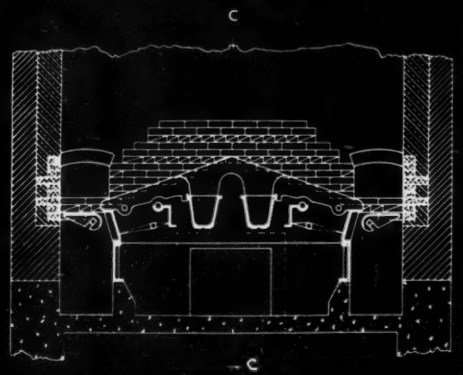
ROTO Division of ELLIOTT COMPANY

147 SUSSEX AVENUE - - - NEWARK 1, N. J.

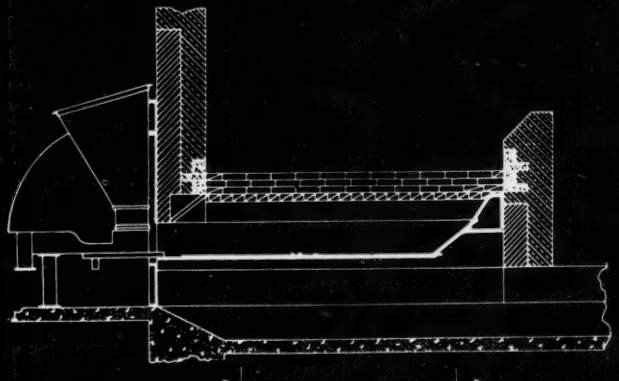
WALL BRICK DATA

"F & E" Underfeed STOKER

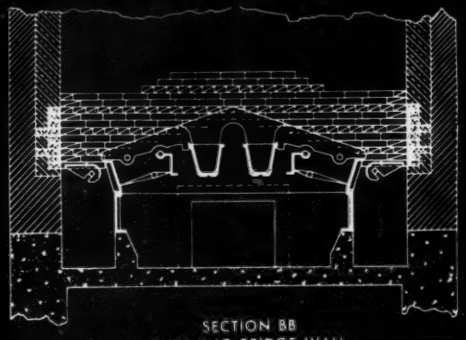
Planning to get more steam cheaper



SECTION AA
SHOWING FRONT WALL



SECTION CC
SHOWING SIDE WALL



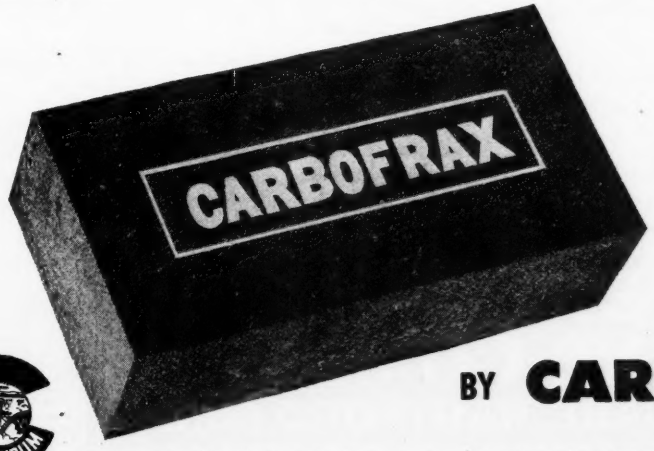
SECTION BB
SHOWING BRIDGE WALL

GREATER CAPACITY AND LOWER COST result when an "F & E" underfeed stoker fired boiler furnace is equipped with a CARBOFRAX silicon carbide brick setting. Lining coverage, as shown here, can be altered of course to accommodate variations in actual on-line working conditions.

Increased steaming production is directly tied to these two basic features of CARBOFRAX brick. The first—an exceptional resistance to steady punishment. Continuous, on-line service is secured. The second—a dense, non-softening surface which is impenetrable to clinkers. Large, restrictive clinker formations cannot build out on the walls.

Free from choking clinkers, the entire grate area is available. This means much more efficient fuel combustion, a more active fire, and lower fuel costs. And the longer life of a CARBOFRAX installation effects a marked reduction in maintenance and replacement expense. Reports of 8 to 10 years service are by no means infrequent.

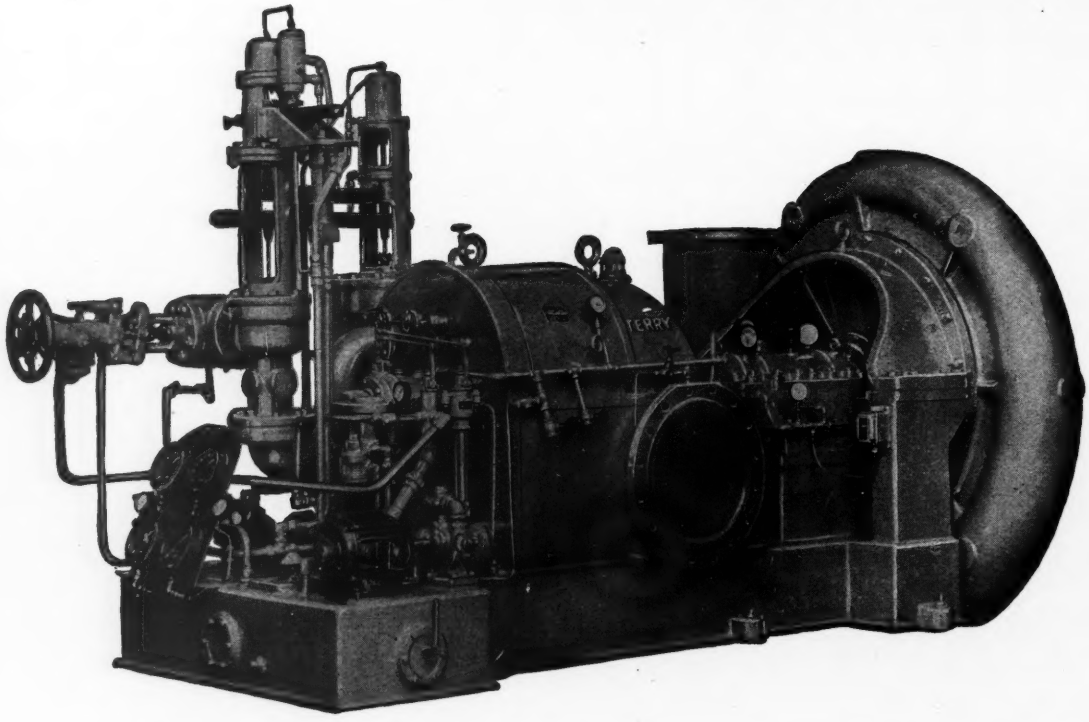
These, and many other advantages, follow the use of CARBOFRAX brick in the clinker zone of stoker fired furnaces. Actual operating figures offer definite proof. It pays to get the complete story. Just request a copy of the technical booklet "CARBOFRAX in Boiler Furnaces." Address your inquiry to Dept. H-76, and we'll see that it is sent to you at once. The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.



BY **CARBORUNDUM**
TRADE MARK

"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

The TERRY TURBINE



SPECIAL MULTI-STAGED TURBINES ENGINEERED TO FIT YOUR REQUIREMENTS

Pictured above is a typical special purpose Terry Turbine. This unit is rated 332 H.P. and can be operated under any of the following conditions:

(1) As a straight high pressure condensing turbine.

(2) As a straight low pressure condensing turbine, thereby converting any excess low pressure steam into power.

(3) As a mixed pressure turbine. It will then absorb all the low pressure steam available and admit just enough high pressure steam to carry the load.

(4) As a condensing bleeder turbine. It will supply clean low pressure steam for heating or process work.

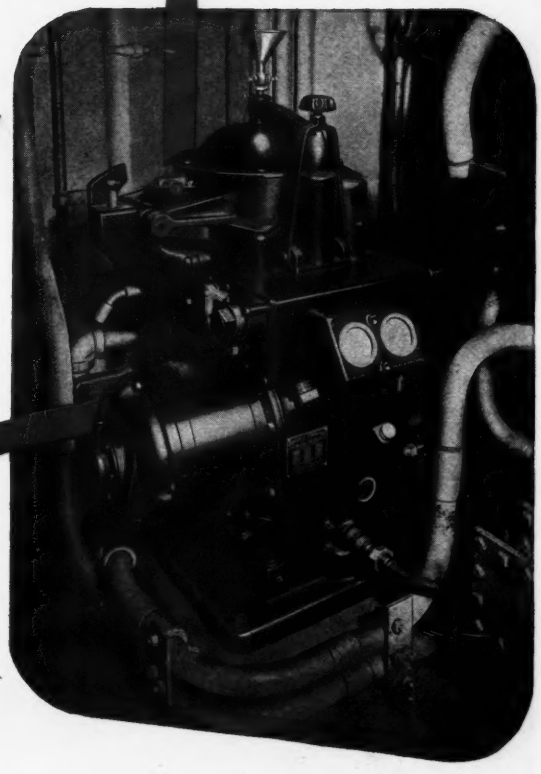
(5) Under all conditions the speed can be varied from 2800 R.P.M. to 4750 R.P.M.

If you have an application for a special purpose multi-staged turbine, Terry will be pleased to discuss the details and make recommendations. Terry Turbines are built in all sizes up to 2000 H.P.

T 1161

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Certainly, REMOVE THE DIRT— *but remove* THE WATER TOO!



WHEN purifying turbine lubricating oil, choose a De Laval Oil Purifier to get rid of ***both*** of these troublemakers instantaneously and continuously. To do a half-way job of oil purification is like carrying half an umbrella in a storm—it is really no protection at all. For water, more than any one other thing, contaminates turbine oil. Condensate leads directly to the formation of sludge, and should a major water leak develop in the turbine serious emulsification trouble would soon occur. Such dangers are eliminated when a De Laval centrifugal is part of the lubrication system.

Solid foreign matter, too, is instantaneously removed and stored in the bowl, outside of the zone of purification.

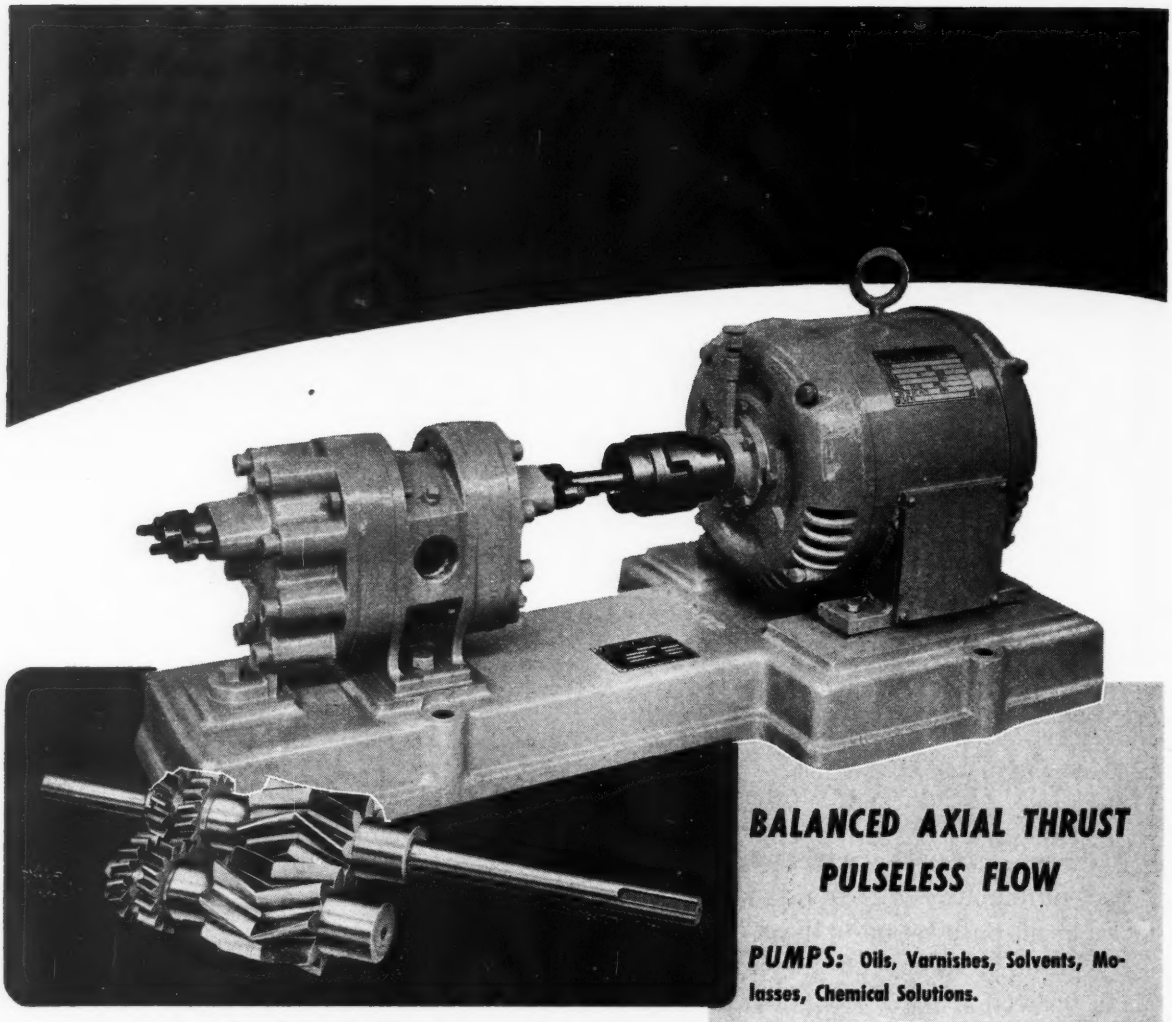
In short, De Laval Oil Purifiers keep oil so clean that its purity can best be compared with that of new oil.

De Laval centrifugals do not remove oil-soluble additives. Because the separation of oil and water and other impurities is effected entirely by mechanical means, the oil loses none of these additives in passing through the Purifier.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL *OIL PURIFIERS*

FOR MORE DEPENDABLE POWER PRODUCTION



BALANCED AXIAL THRUST
PULSELESS FLOW

PUMPS: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

CAPACITIES: 1 to 550 G. P. M.

DISCHARGE: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.

★

For Higher Pressures and Capacities Use

SIER-BATH SCREW PUMPS

The Sier-Bath GEAREX Runs Quieter, Lasts Longer Because of Minimum T.A.E.

● Why should longer life and quieter operation result from cutting the rotating parts of the Sier-Bath Gearex Pump to minimum T.A.E. (Total Accumulated Error)? Because this precision fabricating virtually eliminates timing gear impact loads and stress concentrations. It assures the maintenance of accurate rotor clearance. Thus, it helps maintain high efficiency throughout the Sier-Bath GEAREX Pump's long service life.

In other respects, too, this pump is unique. It provides a pulseless uninterrupted discharge and its rotors are *not in contact*. Deep-toothed, small in diameter, their low pitch line speeds result in efficient, quiet operation not found in the conventional type gear pumps. Their special design prevents trapping. Sier-Bath GEAREX Pumps are equipped with roller bushings for precision running under load.

They are available in horizontal and vertical models, internal and external bearing types, in steel or special alloys, and with jacketed bodies for high temperature applications or where heat must be applied. Write for detailed information.

SIER-BATH GEAR COMPANY, INC.
9256 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

FOUNDED 1905 • MEMBER OF A. G. M. A.

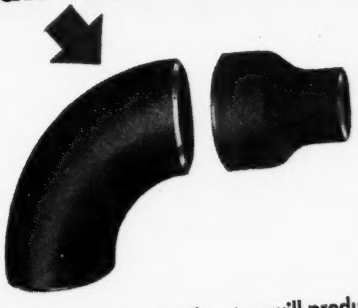
Sier-Bath Gear Co. Inc.

THIS →

IS BETTER

PIPING PRACTICE

Than these Together



Why make three welds when two will produce a better piping job? Where it is necessary to change both the direction of flow and size of pipe, the Midwest Reducing Elbow replaces two welding fittings: (1) a standard elbow and (2) a reducer. The many important features are enumerated at the right.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows: unusual dimensional accuracy and uniformity, beneficial effect of working metal in compression, stress relieving, etc. Center-to-end dimensions are the same as in standard elbows with which they are interchangeable.

The Reducing Elbow is only one of the many Midwest developments designed to improve the quality of welded piping and to save cost in erection. Write for Bulletin WF-41 for complete information about the advantages of Midwest Welding Fittings.

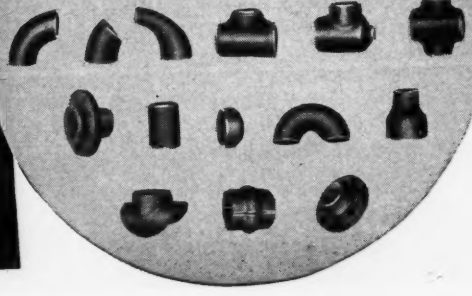
MIDWEST

REDUCING WELDING ELBOW

Eliminates One Weld
Cuts Installation Costs
Saves Time
Reduces Turbulence
Improves Appearance

MIDWEST

WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

• Distributors in Many Cities

GAS ENGINE LUBRICATION

Patented Instrument Guides Elimination of 3% Fuel Waste

IMPROVED EFFICIENCY PERMITS 14 TO 32 THOUSAND HORSEPOWER HOURS PER GALLON OF LUBRICATING OIL

Lubrication Engineer's Report

Since 1940 a prominent Midwestern gas company* has been using the patented Cities Service Heat Prover to check the efficiency of their 20 gas engines.

"Early Heat Prover readings showed a 3% fuel waste under full load. Constantly using the Heat Prover to gauge combustion efficiency, corrections were made and maximum fuel utilization was achieved.

"The following recent check on 8 of these engines shows the unusual results. And they're still going strong. The general average on all of these engines is 14 to 32 thousand horsepower hours per gallon of lubricating oil . . . Cities Service Sentry No. 9 and No. 6."

Engine # 9	*Engine # 14*
Operating Hours Right Side 22006	Operating Hours Right Side 17843
Left Side 22006	Left Side 25002
Liner Right Side 80619	Liner Right Side 30511
Liner Left Side 22006	Liner Left Side 30511
Engine # 10	*Engine # 2*
Operating Hours Both Sides 19353	Operating Hours Right Side 17635
Liner Right Side 42183	Left Side 17635
Liner Left Side 42183	Liner Right Side 17635
	Liner Left Side 17635
Engine # 11	*Engine # 6*
Operating Hours Right Side 15324	Operating Hours Right Side 14189
Left Side 24979	Left Side 17627
Liner Right Side 15324	Liner Right Side 35809
Liner Left Side 24979	Liner Left Side 14189
Engine # 13	*Engine # 7*
Operating Hours Right Side 16968	Operating Hours Right Side 14332
Left Side 24448	Left Side 22556
Liner Right Side 24979	Liner Right Side 30901
Liner Left Side 24979	Liner Left Side 30901

The Cities Service Industrial Heat Prover has been used successfully with every kind of fuel and with every type of combustion equipment in this country. It indicates simultaneously the percentage of unburned fuel and oxygen present in flue gases. With this data the trained Cities Service engineer can show you at once how to *save* on fuel costs and improve efficiency.

Engineering Service Available

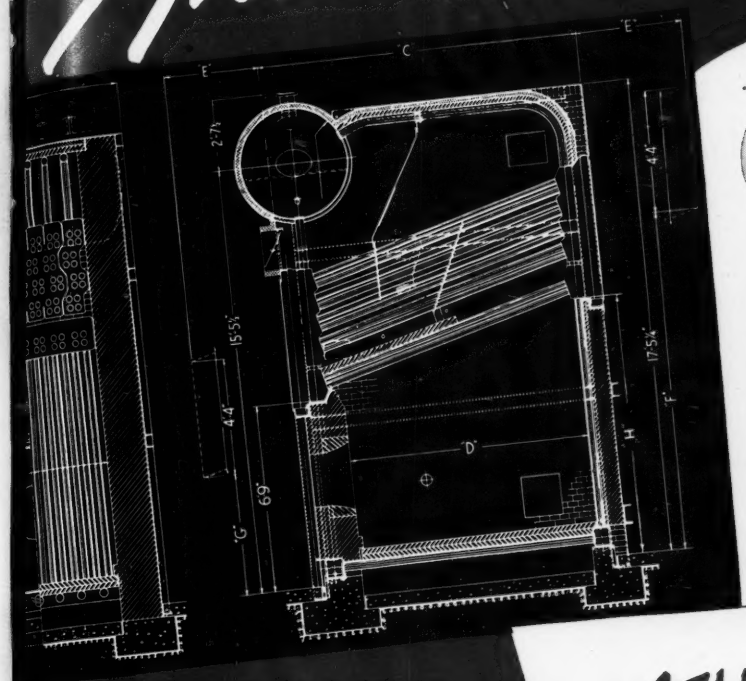
Cities Service Lubrication and Combustion Engineers know ways and means for reducing costs and improving the performance of lubricants. For help or information call the branch office nearest you or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y. (Arkansas Fuel Oil Company, in the South). *Name on request.

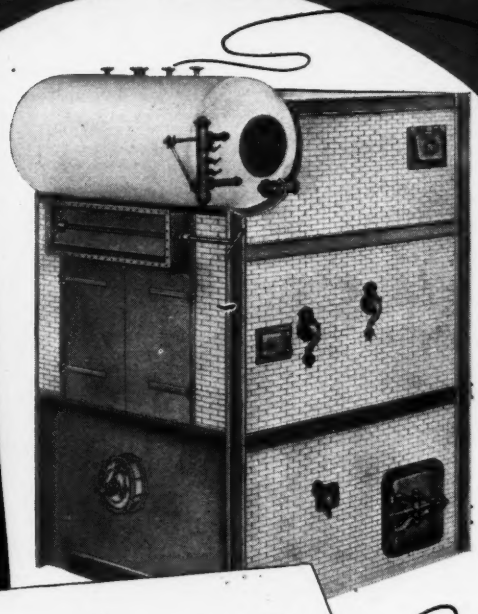
CITIES SERVICE OILS
ONCE-ALWAYS

FOR EVERY LUBRICATION PROBLEM

CALL Cities Service FIRST!

Announcing...





STANDARDIZED TYPE M BOILERS

A New Development . . . Proven by Experience!

SPRINGFIELD standardized Type M Boilers are the logical answer to the problem of meeting rising costs and shortening current delivery schedules. By introducing a standard line, Springfield makes it possible for you to select a REAL POWER PLANT BOILER just as easily . . . accurately . . . conveniently as you order a pump, a motor, or a truck.

The Type M boiler is a tried and tested design, proven highly successful in meeting wartime steam needs. It is approved by reliable consulting engineers.

Ask for interesting descriptive literature.

SPRINGFIELD BOILER CO.
1951 E. Capitol Ave., Springfield, Ill.

QUICK FACTS

- **12 STANDARD SIZES.** Choose the size to fit your needs. From 6,000 to 17,000 lbs. of steam per hour (guaranteed continuous steam generating capacity).
- **STANDARDIZED DIMENSIONS.** Height, depth, all parts standardized; width varies according to size of unit — an ingenious application of the "building block" principle inherently present in the Springfield sectional design!
- **STANDARDIZED FIRING.** Designed for automatic firing with gas or oil. Use any standard industrial burner.
- **WATER-COOLED FURNACE.** Water circulating tubes in front, bottom, and back.
- **QUALITY CONSTRUCTION.** No departure from quality features of finest Springfield steam generating units.
- **LOW ENGINEERING COSTS. QUICKER DELIVERY.** Build your plans around standard Springfield units; save time; all data available. Factory stocks of standard parts facilitate quick delivery.

SPRINGFIELD BOILERS

SPRINGFIELD

STEAM GENERATING UNITS

NY SIZE—ANY FUEL—ANY PRESSURE

MODERN DEVELOPMENTS OF GASKET RESEARCH

V-TITE...

A BETTER JOINT SEAL FOR HIGH PRESSURE LINES

All Industry may benefit from the Petroleum Industry's solution to one of the most difficult gasketing problems.

The Ring-Type Joint, providing an all-solid-metal joint assembly, is fast finding favor in high pressure and temperature steam and chemical processing services.

Goetze V-Tite Gaskets, used almost exclusively by the Petroleum Industry for sealing ring-type joints, are the product of years of mechanical, metallurgical and chemical research.

They are available in Armco Ingot Iron or low carbon steel, 4-6 Chrome Alloy Steel, or any of the several other desirable metals or alloys; in sizes ranging from one to 80 inches in diameter and of standard oval or octagonal shape.

Every step in the fabrication of V-Tite Gaskets, from metal analysis to final inspection, is rigidly controlled to guarantee strict adherence to every detail of specifications. Extremely close tolerances are maintained to secure perfect fit.

Brinell hardness of 80-90 for Armco Ingot Iron and below 130 for 4-6 Chrome Alloy Steel, is carefully maintained by heat-treating. This assures proper flow of gasket material without damage to flange surfaces and undue stress on bolting.

Consider this better sealing method for your post-war plant requirements.

For other gasket data, interesting to engineers, write for a series of technical bulletins, based on original gasket research from the Goetze Laboratory. Please use company letterhead and mention position.

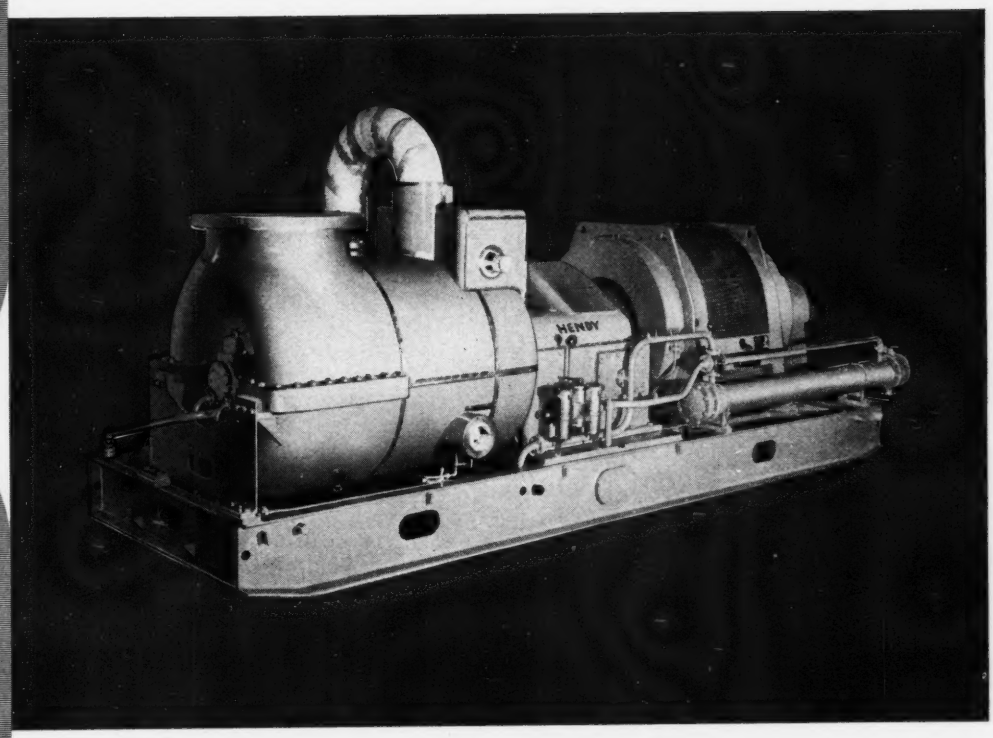
GOETZE GASKET & PACKING CO., INC.
17 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

LOWELL THOMAS Speaks on New Gasket Film

Now available to employee groups, technical societies, engineering schools and other organizations throughout the country, this new 35-minute Kodachrome film, "Only a Gasket," tells why these are the "Biggest little things" in modern Industry. Write for full information.

Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"



HAVE YOU CHECKED WITH HENDY?

You will want to add to your power plant files the new descriptive literature on Hendy steam turbines and turbo-generators. 250 kw. to 7,500 kw.

Power by Hendy

ENGINEERED TO SUIT YOUR NEEDS

Joshua Hendy Iron Works, Sunnyvale, California.
Plants: Sunnyvale and Torrance, California.
Crocker-Wheeler Electric Division, Ampere, New Jersey.
Branch offices: Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Washington.

TG-11

• These aren't ordinary tank cars at all, for if they were they'd arrive at their destination empty—perhaps blown up. They are really "pressure vessels on wheels", designed to keep these gases liquified while in transit by maintaining them under pressures up to 300 lbs. or more.

If you've ever seen such a car the chances are that a Taylor Forge Nozzle provided the outlet, for a large percentage of them are so equipped. These nozzles present an interesting example of the many unusual forged and rolled steel products we are called upon to make for handling liquids and gases under pressure—an example of forging operations that have contributed so heavily to the sum-total of knowledge that enables us to provide extra value in Taylor products in general and WeldELLS in particular.

Yes, extra value in WeldELLS . . . . and here's why. To make the best Welding Fittings that can be made you have to know two important things:

1. What constitutes "the best" design.
2. How to make the metal go where you want it to go in forming so as to provide that design in the finished product.

On the first count Taylor Forge is fully qualified by more than 40 years of the closest association with the piping and pressure vessel fields. And on the second . . . . well, it is only the broadest experience in controlling hot metal under pressure and impact that enables us to provide in WeldELLS all of the features listed opposite—features that are combined in no other welding fitting.

Read the list, please, and we will believe you will agree that

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.
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HELPFUL BULLETINS

Answers to many operating and maintenance problems will be found in these new bulletins and catalogs. List paragraph numbers of those you want on coupon below, detach and mail.

BOILERS

1 **Automatic Steam Generators**—This 8-pg. Bulletin No. 1214 describes the company's steam generating units for light and heavy oil operation which "start with the flick of a switch." The outstanding features of the units are described in conjunction with a cut-away view of the unit. Design advantages are also described. Findings of ASME tests are included and a sample survey form for use in a survey of your plant's needs is presented. Orr & Sembower, Inc.

2 **Boilers and Auxiliaries**—This plastics-bound, plastics-covered Bulletin GS-45-2 covers the entire manufacturing scope of this company. Shop facilities and general experience of the company are first pointed out and then product-by-product illustrations and descriptions take the reader through the vast manufacturing processes. Typical installations are a feature of the booklet. Foster-Wheeler Corp.

3 **Increasing Boiler Capacity**—This bulletin 15 tells about the manufacturer's circulatory system for increasing steam capacities in existing boilers. It shows typical examples of boilers which were increased from a capacity of 25,000 lb per hr to 55,000 lb per hr each, and others which were increased from 22,500 to 55,000 lb per hr each. The bulletin points out that the manufacturer can double the steam capacities in present boilers. John Phillips Badenhausen.

4 **Soot and Fire Scale Remover**—A 6-pg. folder tells about the need for removing soot and fire scale from boiler heating surfaces. Directions for use of the removing compound is explained: for hand-fired boiler, for underfeed stokers, down draft boilers, oil-fired boilers, low temperature points, etc. Perolin Company.

AUXILIARIES, ACCESSORIES

5 **Inserts for Condenser Tubes**—This 8-pg. bulletin tells about this company's metal inserts or wearing strips for inlet ends of condenser tubes. It tells why condenser tube failure so often takes place and also points out, by means of explanatory text, diagrams and actual photos how these inserts help protect against this wear. A report of tests made by the Massachusetts Institute of Technology is a part of the bulletin. Condenser Service & Engineering Co., Inc.

6 **Heat Exchanger Data Book**—This Bulletin 1614 is a nearly complete exposition of heat exchange problems and the company's G-fin sections. The booklet is carefully arranged starting with a description and explanation of these sections, then telling of the design features and advantages. Construction details are clearly shown in an extremely well executed line drawing which is supplemented by tabular material and listing of specifications. Field reports and photographs round out the booklet. There are 16 pages. The Griscom-Russell Co.

7 **Handhole Seat Grinder**—Bulletin Y-22 shows this handhole seat grinder in operation and also presents an unusually good drawing of the grinder assembly. The description tells what the grinder will accomplish and tells how to set it up. Specifications for ordering are accompanied by a line drawing. There are four pages in the bulletin. Elliott, Lagonda Div.

8 **Soot Blowers**—Bulletin HRT-K. Eight pages of information which covers the company's Type K soot blowers for HRT boilers. It tells the work required to be done on the boiler in order to mount the heads. It shows proper location of the blowers and gives specifications of materials. Size of elements and general piping materials required are listed as are general directions for use. Well illustrated with drawings. Marion Machine, Foundry & Supply Co.

9 **Steam Trap Types**—This 4-pg. folder tells about the main differences in construction and operation of the float traps, thermostatic traps, combination float and thermostatic traps, orifice traps, and inverted bucket traps. Methods of hook-up and inspection of the company's steam trap are explained on the last page of the folder. The V. D. Anderson Co.

10 **Boiler Safety Devices**—A condensed catalog and price list for the company's low water cut-off's, boiler feeders, fuel cut-off's, etc., has just been announced. Condensed descriptions are given, illustrations and capacity tables are presented and prices are listed. McDonnell & Miller.

REFRACTORY, INSULATION

11 **Insulation Data Book**—This 28-pg. data book covers the company's insulation for low temperature and cold storage installation. The booklet contains complete, reliable factual information on the use of mineral wool for types of low temperature work. The detailed data and application instructions applying to cold storage insulation are supplemented by several line charts and drawings. One section of the book explains the importance of the vapor barrier. The Eagle-Picher Co.

12 **Refractory Cement**—This 4-pg. Bulletin 313 tells about Fyre-Mortar, a refractory cement for furnace construction and maintenance. Described are the cement's bonding strength, stability, refractory qualities and working characteristics. Directions for its use are described. Quigley Company, Inc.

13 **Refractory Concrete**—This 24-pg. booklet contains basic information on materials and methods used in making refractory concrete for different temperature and insulating requirements. Illustrations show a wide range of applications for refractory concrete in the construction of furnaces of various types. A section of the booklet is devoted to heat-resistant concrete for foundations, floors and structures subject to soaking heat. The Atlas Lumnite Cement Co.

INSTRUMENTS, CONTROLS

14 **Pyrometer Bulletin**—Bulletin 232, 16 pages, is entirely devoted to this company's electronic potentiometer pyrometer. The bulletin starts out by detailing what the pyrometer does for you and then describes its characteristics, gives specifications and lists the standard charts. Photographs and schematic wiring diagrams increase the usefulness of the booklet. Performance data, diagrams and description of the principles of operation are also given. Bailey Meter Co.

15 **Electrical Instruments**—20 pages of information on the company's line of electrical instruments are contained in this Bulletin No. 46 issued recently. The booklet shows the how's and why's of precision movements in the instruments; gives descriptions and specifications on each model instrument and the panel layout. Prices are included. Burlington Instrument Co.

16 **Thermostats and Relays**—Bulletin T, a 12-pg. catalog presents significant information on this company's mercurial thermostats and adjustable thermoregulators. Also included is complete data on relays, designed as companion instruments to the above mentioned. Complete descriptions of the instruments are included and the bulletin is well illustrated. Precision Thermometer & Instrument Co.

17 **Measuring Miniature Flow Rates**—This catalog 52-A describes the company's "Rota-tronic" remote instruments which are for use with rotameters to indicate, record, totalize and control miniature flow rates down to 5 milliliters of liquid per minute and, for gases, 20 milliliters per minute. Method of operation is fully explained and is supplemented by a line diagram. Technical and application data is also an important section. Fischer & Porter Co.

18 **Electrical Instruments Data Book**—This 18-pg. booklet tells about portable and switchboard type electrical instruments in the company's line. Shown, with complete tabular material and specifications are: ammeters and voltmeters, wattmeters, shunts, resistors and special instruments. Line drawings and photographs are used to illustrate the booklet. The Norton Electrical Instrument Co.

19 **Electronic Temperature Control**—Bulletin D4-2, a 4-pg. piece, describes the company's newest development in its series of electronic temperature controls, the Multronic Capacitor. A photograph, on which the various parts are labeled, helps in the explanation of the device. The unit's operation is completely described and a three-color diagram accompanies this description. Specifications and hook-ups are also included. Wheelco Instruments Co.

20 **Water Level Control**—An explanation of how the water level on the boilers at Parkchester, the huge Metropolitan Life Insurance housing project in New York, is controlled is explained in this monograph. Photos of the project, the boiler installation and the control equipment aid in the explanation. Line drawings and reproductions of the boiler meter charts augment the description. Bulletin 451; 8 pages. Northern Equipment Co.

21 **Catalog on Gages**—This catalog No. 44 is described as the only complete technical catalog ever written on pressure gages. Cut-away photographs, line drawings show the complete line of gages, tell how they work, what goes into them, how they are put together and the reason for their accuracy. Two full pages of standard dials are shown and gage case dimensions are accompanied by tables of dimensions. Helicoid Gage Div., American Chain & Cable Co., Inc.

WATER TREATMENT

22 **Water Treating Hankbood**—This booklet starts with the known fact that water contains impurities and the acknowledged fact that it is necessary to remove or neutralize them and works its way, through logical sequence to the methods and mechanism of treatment. The company's preparations are described and drawings illustrate methods of introduction to the line. American Sand-Banum Co., Inc.

PIPING, VALVES

23 **Valve Streamlining**—A study of how streamlining cuts down pressure losses through valves is the subject of this 6-pg. bulletin 702. Photos show the setup of the laboratory in which the studies were made and the results are shown in chart and descriptive form. Formulas for pressure losses are presented. Edward Valves, Inc.

24 **Line Purifiers**—The line purifiers described in these two bulletins are designed to remove all entrained impurities and water from steam, air, gas or vapor lines. Method of operation and manner of design are described and line drawings aid in the description. Bulletins 174-A and 212; both have two pages. Centrifix Corp.

25 **Quick Coupling for Pressure Lines**—Bulletins and descriptive literature on a new quick-coupling for use on lines and hoses operating under pressure have been issued by this company. It is pointed out that the coupling is particularly adapted for hydraulic and pneumatic lines running from pressurized tanks. The unit

JULY, 1945

POWER PLANT ENGINEERING
53 W. Jackson Blvd.
Chicago 4, Illinois

Please have the manufacturers send me without obligation the literature indicated by the following paragraph number.

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City ..... State .....

is described as having but three major parts—the cam ring, ball cage and nipple. Safe pressure limits for the ¼ in. unit are shown to be 11,500 psi, and for the 2 in. coupling 1680 psi. Temperature limits are from minus 65 F to plus 300 F. Roylyn Mechanical Laboratory.

METAL PROTECTION

26 **Cathodic Protection**—This 16-pg. bulletin tells the results of a test to determine the advantages of using magnesium as a source of current for cathodic protection installations. Line diagrams and charts parallel the text and data presented shows how the tests were conducted, laid out and tells the findings. The Dow Chemical Company, Magnesium Div.

27 **Boiler Metal Treatment**—This folder tells about boiler metal treatment and, by means of cartoons, shows the affinity of the compound for the boiler metal, how it permeates the scale in the boiler and then, by expansion, forces the scale from the metal surfaces. The action of the compound is explained and its use outlined. Perolin Company.

28 **Electrical Water Treatment**—These two bulletins describe the company's method of treating water and protecting boiler metal. The function of the method is described as "to pick up the current and static electricity from a boiler or water line and positively expel it from these units and thus stop all scale formation, pitting, foaming and priming." One of the booklets contains 12 pages and is completely devoted to a story of the theory behind the equipment and of the equipment itself. The second bulletin is a single sheet which presents line diagrams illustrating the principle of operation. NoKeM Engineering Co.

29 **Protecting Underground Pipe Lines**—This 8-pg. bulletin first outlines the characteristics and properties of magnesium and then tells about the manner in which underground pipe line installations corrode or are subjected to corrosion. Line diagrams and photographs show how to install the protection hook-up. The Dow Chemical Co., Magnesium Division.

POWER TRANSMISSION

30 **New Type V-Belt**—This 6-pg. bulletin tells all about a recently developed V-Belt made of leather and also about the new chain link couplers that permit the installation of the belt in places which are hard to get at and that does away with trouble and inconvenience when one or both pulleys are inside the hanger. One complete section of the bulletin describes and illustrates the application and operation and also shows how to determine the horsepower required of each belt. List prices are included. S. R. Sikes Company.

31 **Belting Catalog**—Designed to aid all industrial plants and maintenance men in the selection of the right equipment for the job is the new belting catalog issued recently. Information in the two-color loose-leaf publication includes specifications on the company's line of conveyor, transmission and elevator belting. Maintenance suggestions advise users how to prolong the life of belts and thus avoid costly production delays. Hewitt-Robins, Inc.

32 **Power Transmission Handbook**—This Handbook AED-45 consists of 72 pages of closely packed information on motor mountings and belt drives. Tabular material—drive selection tables, dimension tables, installation instruction data, tables of sheave information, list prices and flat belt drives—is an outstandingly useful section of the book. The selection of special drives is completely outlined and explained. The book is well illustrated and arranged for maximum usefulness and readability. The American Pulley Co.

33 **Technical Data Book on Retaining Rings**—Catalog No. 4, a 48-pg. technical data book, highlights new developments in retaining rings and covers varied applications of 7 basic retaining ring types. Before and after design sketches of many basic and unusual applications show how the rings may be used to save space, weight, machining and assembly costs. Comparative charts on material characteristics, critical dimensions, thrust loads, and impact tests are included. An easy reference table gives the correct retaining ring size and number for every type of commonly used ball bearing. Truarc Dept., Waldes Kohinoor, Inc.

TOOLS

34 **Metal-Working Machine Tools**—Here is a 36-pg. catalog, No. G-3-2R N. P., which covers machine tools for industry. Band saws, drill presses, drill press attachments, grinders, lathes, motors, accessories, surfacers, etc., are shown. Line drawings and photos are used to illustrate the book and to give dimensions. Specifications are included. Walker-Turner Co., Inc.

35 **Electric Tools**—40 pages and a cover are included in this Catalog 464 which describes the company's line of electric tools for maintenance and construction work. Included in the catalog are electric hammers, drills, many hammer tools, hole saws, brushes, arbors, sanders and grinders. The booklet is well illustrated and indexed. Syntron Co.

PUMPS

36 **Rotary Pumps**—Bulletin 10 covers the company's new line of ¾, 1½ and 3 gpm series K rotary pumps; these units are said to be adaptable to a wide range of jobs from deisel fuel transfer work to fuel supply in industrial plants. Construction features of the units are shown in exploded views and dimension and specification information is presented. Performance charts are also given on the last page of the folder. Geo. D. Roper Corp.

37 **Power Pumps**—Bulletin W-414-B44 tells about the Type VTE power pumps and gives complete tabular data on sizes, speed, displacement, discharge pressure, etc. Sectional drawings are used to illustrate certain features of the units and specifications for both the power and liquid ends are given. Tables of general dimensions are presented with dimensioned drawings. Worthington Pump & Machinery Corp.

38 **Pump Booklet**—This Bulletin G845 covers the company's axial flow pumps for capacities up to 100,000 gpm and heads to 50 ft. This type of pump is described as providing inexpensive protection against floods for industrial plants, large buildings, municipalities, etc. Other uses are for condensate circulation, sewage plant circulation, irrigation, etc. The bulletin presents details of construction, shows typical installations, is well illustrated with line drawings and other pictures and features selection tables and other engineering data. Economy Pumps, Inc.

DIESEL

39 **Better Diesel Performance**—This four-page bulletin tells how to obtain better diesel performance; it tells about a penetrant for quick cleaning of diesel engine cooling systems, another one for rapid descaling of diesel engine water jackets, and a renovator to produce sparkling paint work on diesel equipment exteriors. Also included is a card which can be used to bring the reader a Service Report on Modern Diesel Engine Maintenance which tells how to maintain the engine at the peak of efficiency. Oakite Products, Inc.

HEATING

40 **Heating Specialties**—These specialties for low pressure heating are return line traps, thermostatic traps, vent float traps, quick venting valves, air line valves, radiator valves, and air eliminators. Besides descriptions of the units there are presented roughing-in and capacity charts. 6 pages. Monash-Younker Co., Inc.

41 **Heating Specialties**—Catalog D-99 contains 20 pages of information on the company's specialties for warm water radiator heating including circulating pump, relief valves, reducing valves, combination controls, flow checks, and venturi fittings. Design tables for systems using steel pipe are given, for copper pipe; installation details are outlined and illustrated. Piping construction details are shown in line drawings. A tremendous amount of heater installation details are included and an equally great amount of tabular material on all phases of the subject make the book unusually helpful. Taco Heaters, Inc.

MISCELLANEOUS

42 **How to Make Isometric Drawings**—Here is a 20-page book in which the principles of pictorial engineering drafting, as utilized in isometric and dimetric projection, are explained clearly and concisely. It was written by Paul F. Boehm. In addition the booklet tells how the new stencils (Instrumaster) have been especially developed to make the construction of isometric and dimetric drawings not only easier and faster than possible with conventional methods but more accurate as well. John R. Cassell Co. Inc.

43 **Pneumatic Conveying Equipment**—This 4-page bulletin No. 143 tells about the company's vacuum equipment for pneumatic conveying of flue ash, charcoal, coal dust, etc. Illustrations and line drawings supplement the descriptive material. Typical installations and uses are pictured. The Spencer Turbine Co.

44 **Bearing Metals**—This 8-page bulletin tells how to make and maintain journal bearings, how to clean shells, use of mandrels, melting of metal, pouring and finishing. Line drawings are used to illustrate this section. Physical characteristics of the company's bearing metals are tabulated and descriptions of each are given. Recommended applications take up one page of the bulletin. Magnolia Metal Co.

45 **Fuel Oil Treatment**—This six-page folder tells how the company's fuel oil treatment converts sludge into heat, emulsifies water in oil and keeps lines and burners clean. Quantity of compound required, method of application and actual experiences are told. Perolin Company.

46 **Sludge Reactivator**—This new 8-page illustrated booklet fully explains the principles of upward sludge filtration and describes its adaptability to the effective treatment of both industrial and municipal water supplies. Charts, flow diagrams and cut-away drawings show clearly how this equipment can soften and clarify raw water, materially reduce reaction time and provide a treated water, that in many cases, is suitable for process use without further treatment. Graver Tank & Mfg. Co.

47 **Rust Prevention**—This Tenth Anniversary catalog tells all about the various types of Nox-Rust applications and pictures and describes each of them. Each page is devoted to a typical application and a brief paragraph tells about the properties of the particular compound and shows how it is applied. There are 24 pages in the catalog. Nox-Rust Chemical Corp.

48 **Mycalex Data Book**—A new 24-page booklet, CDP-522, on Mycalex, a stone-like product composed of mica and a special glass has just been published. It describes in detail the available types, molded parts, fabricated parts, machining practice and how and where to order the material. The design section of the booklet explains the size range, thicknesses and undercuts, etc. that are practicable and gives much other information. General Electric Co., Pittsfield.

49 **Flooring Booklet**—This new bulletin number 601 describes a heavy-duty, non-absorbent and acid-resistant industrial flooring known as Emeri-Crete. Comparative strength analyses of popular flooring materials are charted in the book and numerous installation photos are presented. Walter Maguire Co., Inc.

50 **Dust Collectors**—Individual-type dust collectors suitable for collecting dust, dirt and lint from dry grinding, buffing, polishing etc. are described in this new bulletin A-350. Also shown is a vapor collector designed to collect vapor from screw machines and similar machining operations employing coolants. Specifications of models with ratings, prices and accessory equipment are given. Aget-Detroit Co.

51 **Stainless Steel Strand**—This six-page bulletin tells about the uses and properties of the company's stainless steel strand; explains its use as a ground wire for high tension transmission lines, as a messenger wire, for catenary construction on electrified railways and as guy strands. The physical characteristics and 7 basic improvements are given. Tabular material gives specifications. Page Steel and Wire Div.

52 **Silicone Rubber**—Number 1A of a series of bulletins is "Silastic-Silicone Rubber." Properties and suitable applications of the rubber are set forth and tables present: Physical Properties; Chemical Resistance for Molding and Extruding and the Effects of Ageing. There are 4 pages. Dow Corning Corp.

53 **1 Plastics Avenue**—The annual "One Plastics Avenue" Bulletin CD-530, has just been issued. This 20-page booklet, done in four colors, describes the company's complete plastics facilities—research, development, design, engineering, moldmaking, manufacturing, compression molding, injection molding, laminating and low pressure molding. General Electric Co., Pittsfield.

54 **Dust Collector**—This collector, described as easy to install on grinders, buffers, sanders, polishers, lathes and other machines, is described in this bulletin. A phantom view of the unit traces the flow of air through it and assists in an explanation of the unit. The folder also points out other products in the company's line. Ideal Industries, Inc.

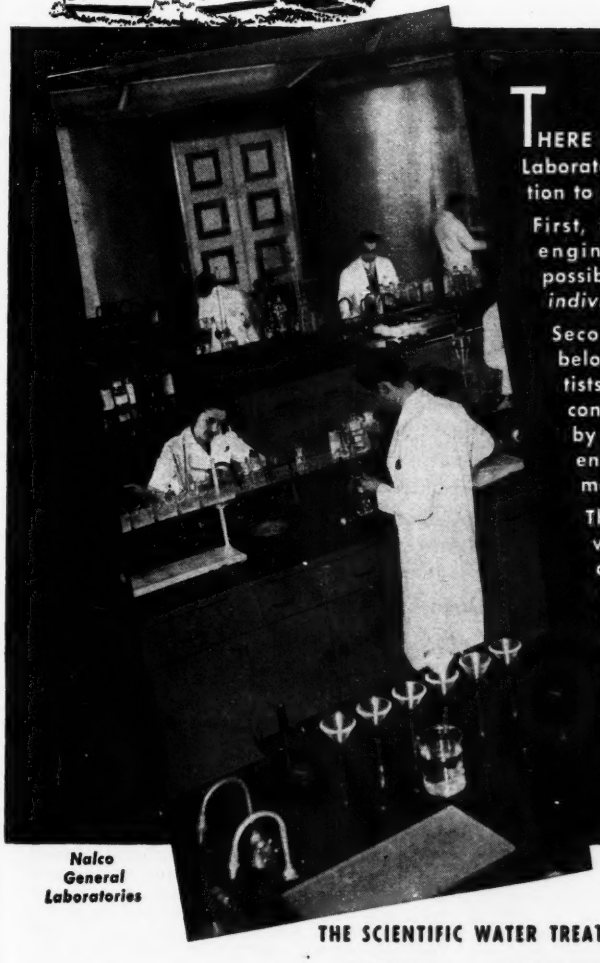
(Continued on page 158)

.....This..... is really an addition to *your plant!*

says:

J. G. Clausen

Nalco Representative
Western New York State



Nalco General Laboratories

THERE are two reasons why we say that Nalco, its Laboratories and Service Organization, is really an addition to your plant:

First, it was conceived as a service to power plant engineers . . . the only means of getting the best possible water treatment information and action on an *individual plant basis.*

Second, on the theory that the Nalco Laboratories belong to practicing power plant engineers, the scientists and chemists who operate them are primarily concerned with the plant problems brought to them by Nalco Service Engineers . . . An interest that has enabled Nalco to contribute heavily to most successful modern water treatment practices.

Therefore, it is easy to see that the world's finest water treatment laboratories are, indeed, a part of your plant . . . Your facilities to use whenever necessary to get the best possible answer to your water treatment and control problems.

You are invited to put your Nalco Laboratories to work, now. Ask for a Nalco Survey that will give you a detailed picture of your present water treatment situation. Recommendations (if necessary) will be made to help you achieve the many advantages of complete scientific water treatment.

THE SCIENTIFIC WATER TREATMENT FOR ALL INDUSTRY

NATIONAL ALUMINATE CORPORATION

6224 West 66th Place, Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

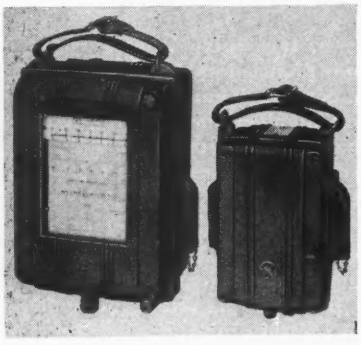
Nalco

New Equipment News

The new equipment items in this section are identified by letters which precede the headings. When further information is desired regarding any of this equipment write this corresponding letter on the postcard in the Helpful Bulletins section, tear it out and send it to Power Plant Engineering, 53 West Jackson Blvd., Chicago 4, Ill.

A Inkless Temperature Recorder. Announcement of an inkless temperature recorder, designed for use with resistance temperature detectors (RTD's) already installed in generators, transformers, and other electrical apparatus, has been made by the Meter and Instrument Division of the General Electric Co. The new instrument can also be used with separate detector units to record temperature in ovens, heat-treating tanks, refrigerating machines, air ducts, and liquid handling systems.

Designated as the Type CF-2, the temperature recorder consists of a portable recording instrument and an external power-supply unit. The equipment records by means of an inkless recording mechanism on a 4-in. strip chart the temperature variations that produce resistance changes in standard, ten-ohm RTD's heretofore used mainly with indicating instruments. The range of the fixed scale and chart scale on the recorder is 20 to 140 C. With a chart length



of 65 ft, the driving motor can be adjusted to provide record length of from eight days to two years on a single chart. Weight of the recorder is 11 lb. Dimensions are 7¼ by 5 by 4-1/16 in.

The external power unit contains the constant voltage d-c source, a part of the bridge circuit, and a lead-resistance compensating device. The weight of the power unit is 5 lb. Dimensions are 9¾ by 7⅝ by 6 in.

B 30 Deg. Globe Valve. Representing a marked advancement in valve design is this new series "V" and "VL" valves. Extreme thirty degree valve body design in the globe pattern effects a minimum change in the direction of flow through the valve. Likewise, turbulence is almost entirely eliminated, as the flow stream is carried through the valve in the direction of closing. Expansion takes place directly into the downstream line after the flow has passed through the valve. Thus wire drawing and cutting action is almost entirely removed.

A solid one piece stem and plug is employed to effect absolute tight shut-off when closed. The valve stem is not directly carried by the handwheel which removes any chance of the stem becoming distorted or bent. All shocks are absorbed by a multiple full threaded section of the handwheel and yoke. All threaded surfaces and operating parts are protected from paint, dirt and damage by an encasing cap shield.

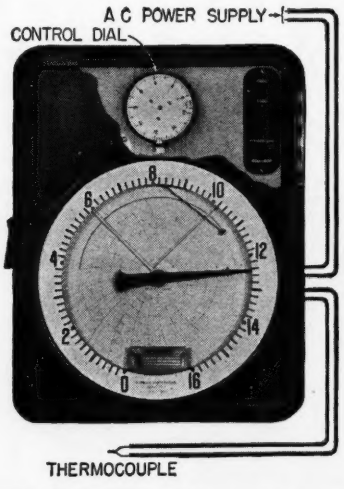
Essential operating parts of the valves are provided constant "lifetime" lubrication by a special factory sealed process. The sealed lubricant

is "zoned" entirely away from the flow stream and isolated from temperature effects to insure lasting permanence, it is announced by Grove Regulator Co.

C Electronic Potentiometer-Pyrometer. A new electronic potentiometer-pyrometer which has no continuously moving or vibrating parts in its measuring circuit is announced by Bailey Meter Company. It records one or two temperatures on a 12 in. diameter uniformly graduated chart and indicates on a 29 in. bold scale which encircles the recording chart.

This indicating, recording and controlling instrument requires a 115-v, 60 or 50 cycle, a-c power supply. It operates from a thermocouple or from any source of d-c potential which varies through at least 10 millivolts for full scale range. Conventional thermocouples are used for temperatures up to 3000 F. For temperatures above 3000 F and for moving objects above 1500 F radiation type thermocouples are used.

Trouble-free service and a minimum of maintenance are said to be insured by the elimination of all the continuously moving or vibrating mechanisms from the measuring sys-

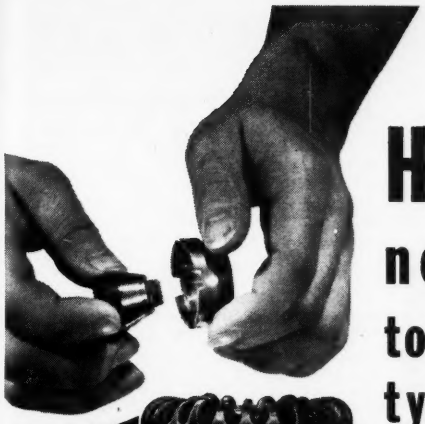


tem. Only the recording chart moves continuously. The reversible electric motor which drives the indicating, recording, and controlling features moves only when the potentiometer network tends to become unbalanced because of a change in the factor being measured.

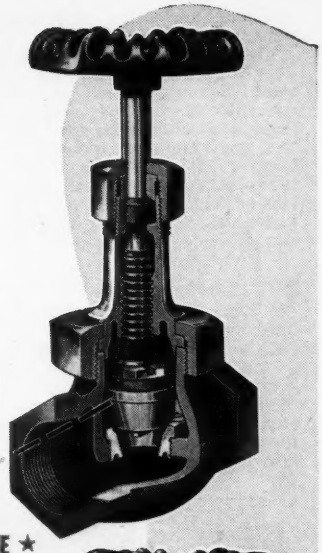
It may be furnished with two controllers operating from two entirely separate measuring circuits all housed in the same recorder casing. This arrangement permits double the number of recorder controllers to be included in a given panel space.

D High-Speed Detergent. Promising even greater speeds and lower costs for industrial steam-cleaning operations, a new heavy-duty alkaline-type detergent specially designed to use in modern steam guns and coil-type steam generating mechanisms has been announced by Oakite Products, Inc.

The new high-speed detergent, called Oakite Composition No. 92, has been pretested during the past year. Decisive reductions in time and cost allocations for such jobs as the following are said to have been recorded: Cleaning machinery and equipment parts for subsequent repair and overhaul, preparing equipment surfaces for repainting or refinishing, cleaning equipment too large for tank immersion or where suitable tanks are not available, paint



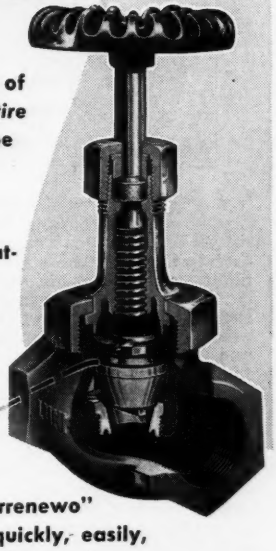
Here's all you need... to convert a regular type into a plug type valve...



BRONZE "RENEWO" VALVES

REGULAR TYPE
Fig. 73....200 lb. S.P.
Fig. 16....300 lb. S.P.

PLUG TYPE
Fig. 73-P. 200 lb. S.P.
Fig. 16-P. 300 lb. S.P.



IRON BODY "FERRENEWO" VALVES

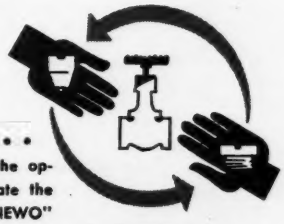
REGULAR TYPE
Fig. 1021...150 lb. S.P.

PLUG TYPE
Fig. 1021-P. 150 lb. S.P.

SEATS AND DISCS INTERCHANGEABLE ★

Just insert a plug type seat and disc in place of the regular type, and you change an *entire* Bronze "Renewo" Valve from regular to plug type —providing all the extra advantages of this type, including its ability to stand up under unusually hard service. No other change is necessary. The plug type seat-and-disc combination is made to *fit perfectly* into a regular type valve of corresponding size and pattern. And you have this same interchangeability in Iron Body "Ferrenewo" Valves. You don't have to buy an entire new valve . . . you don't even have to take the valve out of the line. *Lunkenheimer interchangeability goes still farther. *All parts* of 200 lb. "Renewo" and 150 lb. "Ferrenewo" Valves (except bodies and bonnet rings) are quickly, easily, perfectly interchangeable. Fewer parts are needed; ordering and handling are simplified; repairs are facilitated. You save time, labor, money.

Write for a copy of Circular 567—



LET YOUR LUNKENHEIMER DISTRIBUTOR DEMONSTRATE . .

Your nearby Lunkenheimer Distributor will welcome the opportunity to show you actual samples and demonstrate the interchangeability of parts in "RENEWO" and "FERRENEWO" Valves. You'll find it a big factor in increasing efficiency, lowering costs.

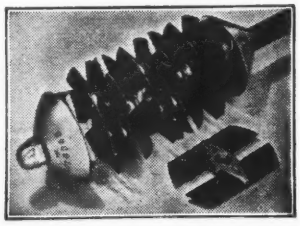
THE LUNKENHEIMER COMPANY

CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13, CHICAGO 6, BOSTON 10, PHILADELPHIA 7.
EXPORT DEPARTMENT: 319-322 HUDSON ST., NEW YORK 13, N. Y.

stripping and other cleaning operations.

The new detergent is described as giving highly thorough and fast steam-cleaning action at very low concentrations. Specialized advantages associated with the product by the manufacturer include: Prevention of scale clogs in steam coils; ready dissolution in hot water; free-rinsing action on all surfaces; safe and pleasant handling without offensive fumes or toxic vapors.

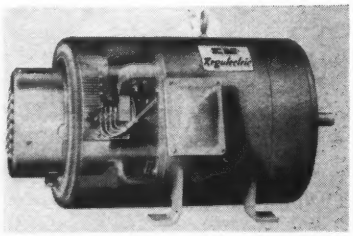
E Boiler Tube Cleaner. The Thor Flue Shaver, shown here, has eleven spring steel blades, each with four cutting edges, mounted on an octagon steel shaft with cast bronze guide bells at each end. The blades are reinforced with spring steel leaves on both sides to provide the right amount of flexibility and also protection from undue strain.



The tool is shipped with only four blades mounted on the shaft and is to be used in this manner for the first few times. The additional seven blades are used as the tubes become clean enough to allow their easy passage. If the full set of blades were used for the first cleaning, the soot and scale shaved off would choke the flue and several men would be required to push the tool through.

A swivel joint is furnished with each tool and is to be connected between the tool and a rod of ⅜ or ½ in. pipe. It is said to eliminate the strain and binding which might otherwise result if the rod were not held in perfect center while pushing and pulling. Goedert Flue Shaver Co.

F New Regulectric Generator. The principle of electrical resonance, long used for needle-sharp tuning of radios, holds voltage constant in the Regulectric a-c generator newly-developed by Electric Machinery Mfg. Co. for use in engine generator sets. The built-in voltage



regulating circuit needs no attention in operation to maintain voltage of power-line quality, since the regulator has no moving parts and is factory-set to hold voltage within ± 2 per cent from no load to full load with normal engine speed regulation.

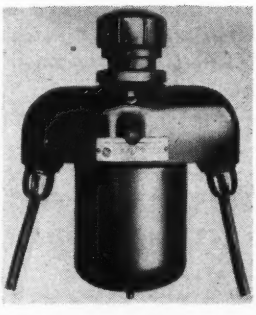
The generator is of the revolving-field type, and is now built in these ratings: 5 and 7½ kw, 60 cycle, single phase, 7½ and 10 kw, 60 cycle, three phase at 1200 rpm and 7½ and 10 kw, 60 cycle, single phase, 10 and 15 kw, 60 cycle, three phase at 1800 rpm.

G Pipe Insulation. A new development is said to stop sweating and dripping from cold wa-

ter pipes easily and quickly. This product, known as Mystik Self-Stik Dri-Pipe, is an insulation which permanently prevents condensation under warm, humid conditions by forming a sheath-like jacket around the pipe. Installation is simplified because of the self-sticking edges on the product with which it is fastened lengthwise to the pipes. The job requires no technical knowledge, mechanical skill or experience. No tools other than a pair of scissors are needed.

Once it is installed, no painting or other covering is required. Its outer backing is a moisture-proof, resinous-coated cloth which prevents dampness from damaging the soft-pliable insulating material. According to the manufacturer, Mystik Adhesive Products Dri-Pipe has been thoroughly tested and proved to stop condensation on cold water pipes under usual conditions. It also can be used for cold air ducts and tanks.

H Heavy-Duty Oil-Fuse Cutouts. Announcement of an improved line of heavy-duty oil-fuse cutouts for overcurrent protection of power distribution systems

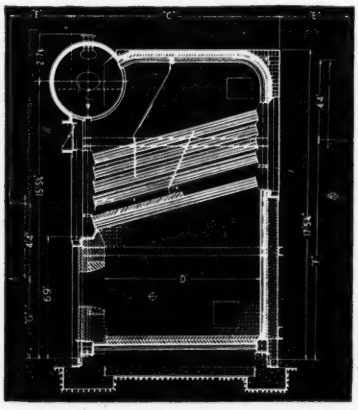


in the 2400-, 4160-, 4800-, and 7200-v classes has been made by the Transformer Division of the General Electric Co.

The improved cutouts utilize the new universal fuse links which provide higher interrupting ratings, clearing fault currents as high as 11,000 amp, depending upon the rating. With this new design, 100-, 200- and 300-amp rating cutouts with maximum short circuit interrupting ratings previously limited to 2500 v are now extended to 5000 v.

The cutouts provide a high degree of safety, for there are no exposed live parts, and no arc flames are ejected during current interruption.

I Postwar Line of Boilers. Development of a line of twelve standard water tube boilers ranging in guaranteed steam generating capacity from 6,000 to 17,000 lb of steam per hour, is announced by Springfield Boiler Co. as a part of a postwar program for shortening current delivery schedules for boilers in this size range. Springfield engineers expect to reduce engineering costs per unit to a nominal figure on the new standard line which will permit adoption of a price list system of quoting on the many small and medium-sized jobs needed in the



power, process, and heating fields. Designated as the Springfield Type M series, the new boilers feature a water-cooled furnace design developed for special applications during the war and found particularly successful where it is necessary to maintain uniformly high efficiency over a wide range of load conditions.

Important from the viewpoint of engineers and architects planning new construction or plant expansion projects, is the standardization of dimensions for various size units. Type M boilers are made with two standard tube lengths, 10 ft and 12 ft expanded into sinuous electric steel sectional headers. Furnace width varies from 3 ft 9 in. to 9 ft 0 in., depending on whether four, five, six, seven, eight, nine, or ten header sections are used. All boilers in the line have 48 in. diameter welded, X-rayed, and stress-relieved steam drums built to various pressure standards ranging from 160 to 320 lb. The overall setting height is 17 ft 5¼ in. for all units.

J New Diaphragm Material. Before the war, goat's skin, and only skins of goats raised in the high peaks of the Himalaya Mountains were considered sensitive and durable enough for use in diaphragms. These skins (unpunctured by mosquitos and unblemished by ticks which can't survive the rigors of the "hump's" climate) were unavailable during the war period.

Askania Regulator Co.'s engineers found a solution to the shortage which proved better than the original diaphragms of fiber glass.

The new diaphragms are non-porous . . . do not sag or stretch . . .

Whatever the job calls for

. . . it's in the Crane line

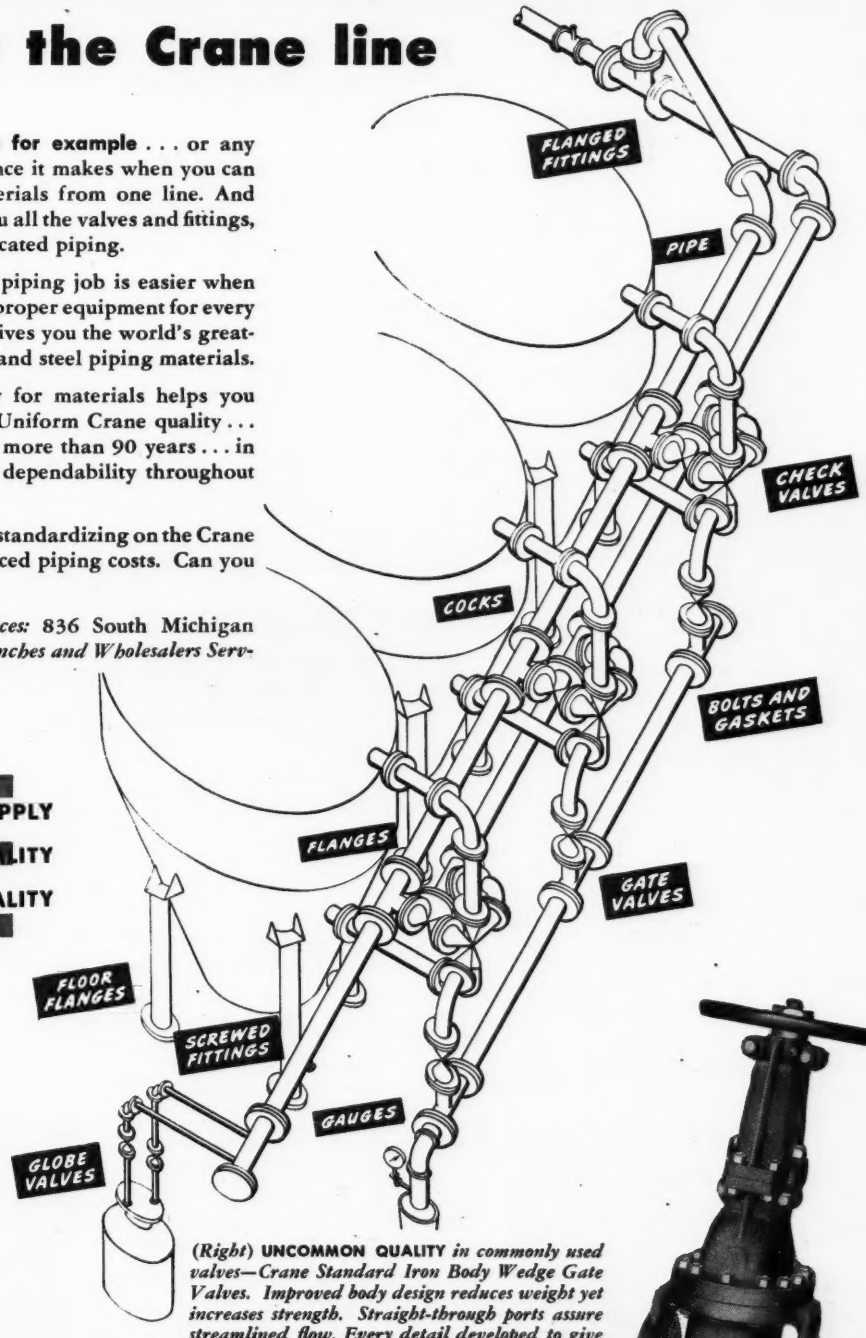
Take this filter installation for example . . . or any piping job. What a difference it makes when you can specify all the piping materials from one line. And when just one order gets you all the valves and fittings, pipe, accessories, and fabricated piping.

From start to finish, any piping job is easier when Crane is your partner. The proper equipment for every service is assured. Crane gives you the world's greatest selection of brass, iron, and steel piping materials.

Undivided responsibility for materials helps you get the best installations. Uniform Crane quality . . . the standard of quality for more than 90 years . . . in every part means uniform dependability throughout piping systems.

This 3-way advantage of standardizing on the Crane line is the sure way to reduced piping costs. Can you afford to overlook it?

CRANE CO., *General Offices:* 836 South Michigan Avenue, Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*



ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

(*Right*) **UNCOMMON QUALITY** *in commonly used valves—Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight yet increases strength. Straight-through ports assure streamlined flow. Every detail developed to give dependable, durable service. For steam pressures up to 125 pounds; 200 pounds cold. Patterns for every need. See Crane Catalog, page 101.*

EVERYTHING FROM . . .

VALVES • FITTINGS
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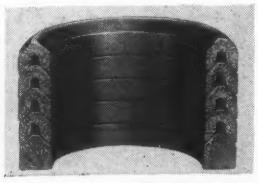
CRANE

FOR EVERY PIPING SYSTEM

are impervious to gases and vapors . . . have high resistance to alkalis and acids and above all else have a much longer life than the previously used goat leather.

In terms of control and instrumentation equipment, this means greater accuracy with less maintenance.

K Pressure - Compensating Packing. The tendency of some "V" shaped packings to weaken and split at the "hinge," appears to have been overcome by a new design which includes heavier wearing surfaces and several other interesting innovations. Known as



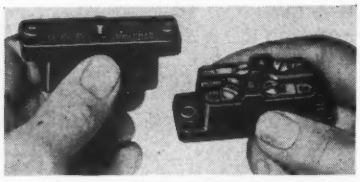
Palmetto Pyramid Packing, this new product is available in molded ring form, made to exact dimensions.

The cut-away illustration of an assembled set shows the method of assembly inside of the stuffing box.

The bottom ring is installed first and receives the full impact of the pressure on the power stroke. This bottom ring expands the wedge-shaped lip of each ring above it so that the packing is pressed against both the rod and side walls, effectively preventing leakage. Binding is prevented by infiltration of fluid between the rings and storage of fluid in the arrowhead reservoir. Ease of operation is assured by the curved design of the interior lip surface, which also prevents friction within the packing.

On the return stroke the lessening of pressure permits the built-in restitutional property of each ring to exert itself, thereby enabling the rings to instantly spring or contract to normal. As a result, any "braking" action by the packing is prevented. This entire function is automatic and requires no attention from the operator. It reduces friction, prevents wear of plunger and provides longer packing life. It has been developed by Greene, Tweed & Co.

L Precision Snap Switch. A new snap switch with virtually an unlimited number of applications has been announced by the Industrial Controller Division of the Square D Co. The device is described



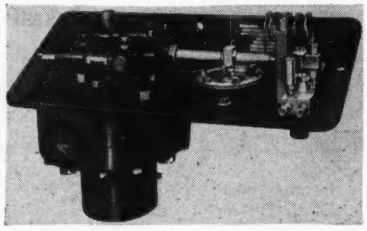
as a self-contained mechanism for making or breaking a circuit, in small space, with short movement and light pressure.

Although small in size (approximately 2½ in. x 1 in. x ⅞ in.), this new Class 9007 Type A Snap Switch features husky construction, unusual mounting convenience and 550 v ratings, all of which greatly widen its range of application. During months of laboratory tests it withstood punishment hundreds of times greater than required in actual service.

Because of its tremendous scope of application, the company is suggesting that industries "write their own tickets" when it comes to putting this new switch to work.

M For Metering Hot Liquids. The photograph shows a pneumatic transmitter (with cover removed) designed for measuring the flow of hot liquids, which are so viscous at room temperature that they congeal in the lead lines. A piston is used instead of the ordinary diaphragm in order to avoid the effect of hot liquids on diaphragms. (Nonmetallic diaphragms are not usable above about 200 F, and metallic diaphragms might give very erratic results at high temperature.)

The transmitter is designed for installation in a manner that keeps the measuring chambers hot enough to prevent the measured fluid from congealing in the transmitter chambers and lead lines. The piston and cylinder are made of steel of the same composition, so that the clearance is



maintained regardless of temperature changes.

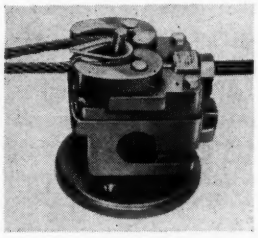
Republic Flow Meters Co. piston type transmitters are now being used for the measurement of coal tar pitch at a flowing temperature of 550 F, and the flow of petroleum tar at 600 F.

N Silicone Insulation. Silicone, the subject of exhaustive study during the past four years by Westinghouse Electric Corp., is said to have an extremely bright future in many insulation applications. Under test runs some induction motors have operated for a total of 3000 hr at 300 C and have not failed, it is reported by the company. Besides the ability to withstand high temperature the insulation resists moisture absorption even under adverse conditions of humidity coupled with high temperature range.

Power house auxiliary drive motors that must operate in high ambient temperatures have benefited from Silicone. An operating coil of a magnetic contactor designed for 100 per cent duty with Silicone insulation was fitted into the same space occupied previously by a coil built for 70 per cent duty.

O New Vise Forms Wire Rope Loops. The Nunn Manufacturing Co. is now in production on a new vise which forms a loop in wire rope by simply turning one hex nut with an ordinary wrench. The vise automatically compensates for rope sizes within its designed range and holds the loop firmly through the splicing or clamping operations.

Cabl-Vise is equipped with a swivel base that accommodates the vise in either vertical or horizontal position



and rotates through 360 deg, clamping firmly in any desired direction.

Cabl-Vise No. 1, illustrated here, takes rope sizes ¼ in. through ½ in. Vise No. 2, equipped with hydraulic booster and accommodating rope ⅝ in. through 1½ in. heavy duty, will be announced shortly.

P Fire Extinguisher. Designed to provide broad protection coverage a new model wheeled portable fire extinguishing unit with a capacity of 750 lb of liquid carbon dioxide is now available. The unit is the Cardox Transitank, manufactured by Cardox Corp. A unique feature of the unit is its extremely high application rate of 300 lb of carbon dioxide per minute from a single nozzle. Shielded behind the cooling screen afforded by this mass discharge, one operator can extinguish a relatively large fire in seconds.

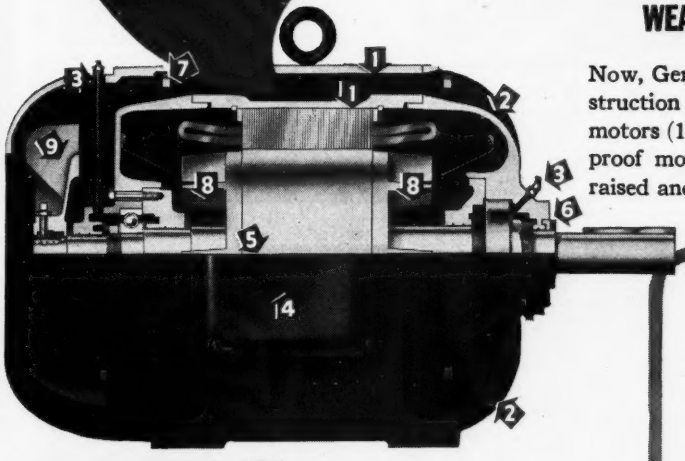
In the Transitank liquid carbon dioxide is stored in a refrigerated and insulated pressure vessel at a constant temperature of approximately 0 F. and 300 psi. At this temperature, the liquid carbon dioxide yields 47 per cent CO_2 "snow" (finely divided particles of dry ice) when released. This high yield of CO_2 snow provides increased cooling effect and effective projection by means of a "Snow-Separation" nozzle. By concentrating the CO_2

snow in one portion of the carbon dioxide discharge, the snow's dense mass can be directed into the heart of the fire through relatively great distances in the presence of strong air currents. As controlled and applied, the carbon dioxide has uniform discharge and extinguishing characteristics.

DOUBLE WALL *Keeps trouble out*

NEW *TRI/CLAD* TOTALLY ENCLOSED MOTOR IS MORE FULLY PROTECTED FROM DUST, DIRT, WEATHER, OR WHAT-HAVE-YOU . . .

Now, General Electric has applied Tri-Clad construction to its line of totally enclosed induction motors (1 to 1000 hp) and to most of its explosion-proof motors as well. ***Extra protection*** has been raised another notch.



FOR EXTRA-SEVERE JOBS

Applications amid dust, metal filings, coolants, or corrosive agents, where totally enclosed motors have always been required, will now have the benefit of a stronger armor, plus convenience features that simplify installation and servicing.

FOR EXTRA-WET LOCATIONS

Indoors or out, these Tri-Clad totally enclosed motors will take hosings or heavy rains without danger of shutdown. The cast-iron frame is strongly resistant to rust and corrosion.

FOR EXTRA LONG LIFE

Many motor users are making the totally enclosed motor their standard for *all* jobs—based on evidence of long-term savings. This new member of the Tri-Clad line makes this decision more logical than ever.

HAZARDOUS ATMOSPHERES

"Companion motors" to the standard Tri-Clad totally enclosed, the new explosion-proof and dust-explosion-proof types are tested and listed by Underwriters' Laboratories for Class I Groups C and D, and Class II Group E, F, and G.

THESE 9 POINTS

of new strength and serviceability put this Tri-Clad totally enclosed motor way ahead

1. A cast-iron, double-wall frame that completely encloses windings and punchings
2. Ribbed cast-iron end shields, machined to provide a tight seal, yet easily removed
3. Well proved pressure-relief greasing systems which can be packed with a long-life lubricant where advisable
4. Cast-iron conduit box diagonally split for wiring convenience (independently explosion-proof on explosion-proof motors)
5. Leads are sealed in a nonshrinking compound at the point where they emerge from frame
6. Rotating, labyrinth seal prevents infiltration of grit or liquids
7. Large, free-flowing, easy-to-clean air passages protect parts from accumulation of dust and foreign matter
8. Modern "ageless" insulation treatment includes Formex* magnet wire
9. Powerful external fan is removable, simplifying maintenance. (Nonsparking type for explosion-proof motors.)

AND IN ADDITION —compactness and short length promote ease of handling and installation.

*Trade-mark Reg. U.S. Pat. Off.

GENERAL ELECTRIC

750-257C-8066

FOR THE COMPLETE STORY

GENERAL ELECTRIC COMPANY
Apparatus Dept., Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motor.

Please send me GEA-4131, "Motors and Control for Hazardous Locations."

Name.....

Company.....

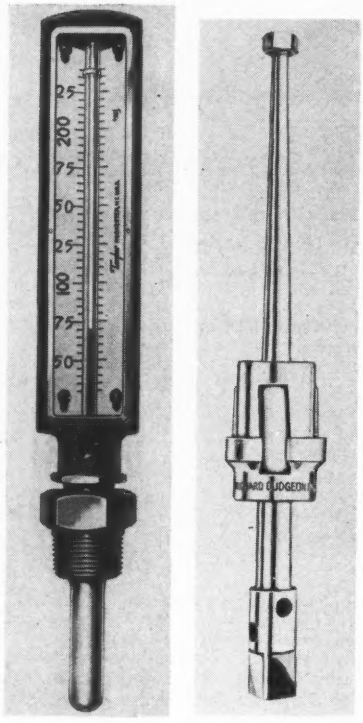
Address.....

3803

Q Industrial Thermometer. Developed for the U. S. Navy and Merchant Marine by Taylor Instrument Co., this 5 in. mercury-in-glass thermometer is now available for industrial use.

This thermometer is designed for use where space is limited and instruments are subjected to unusual vibration. Ideal for such applications as Diesel engines, air compressors, lubrication oil lines on motors, generators, reduction gears, and small diameter brine, water and steam lines.

The instrument has easy-reading Binoc tubing encased in a compact, one-piece case. There are a variety of stem forms: Straight, 90 deg angle, 90 deg right side angle, 90 deg left side angle, or 45 deg reclined (135 deg oblique) angle, which permits the selection of the proper thermometer for correct installation and greatest ease in reading. Ranges available are: Minus 40 to +110 F., 30 to 180 F., 30 to 240 F., and 200 to 500 F.

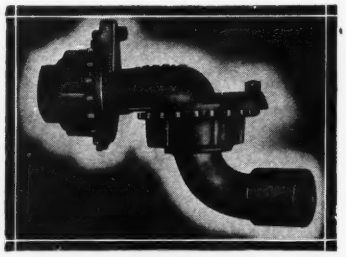


R Tube Expanders. A new line of tube expanders featuring simplified design has been announced by Richard Dudgeon, Inc. This Model 16 expander is described as serving for all general boiler work, boiler making and boiler repair. The simplified design—with a minimum of parts—frame, rolls and mandrel—is said to have resulted in an easy-to-use, economical tool. The expander is designed for ready dismantling and for the quick insertion of new rolls. The frame holding the rolls is of one piece heat treated steel, hardened to give durability. Mandrels and rolls are of hardened tool steel.

The rolls are extra long and are reversible for longer service. They are set at an angle with the mandrel for self-feed. Reversing the mandrel releases the expander from the tool.

The expanders are further described as compact and that they do not draw the tubes out of the shell.

S Flexible Joints. A recently developed flexible joint made by Flexo Supply Co. makes possible flexible pipe connections to moving machinery under high or low



pressure, heat or cold, with steam, air or liquids. Among the advantages pointed out by the manufacturer is the ability of the joints to swivel through 360 deg yet maintain positive control over the flow of the fluid contained.

These joints are described as consisting of only four parts, each one interchangeable, and made in all standard pipe sizes from ¼ in. up to and including 3 in. with threaded ends. Four styles are available. The joints are made of bronze and are designed for working pressures up to 250 lb and temperatures not exceeding 500 F. For high pressures they are made of cast steel and are for use with pressures up to 1350 lb and temperatures above 500 F.

T Pipe Joint Compound in Stick Form. Lake Chemical Co. announces Pipetite-Stik, pipe joint compound in handy, clean, easy-to-use stick form. All that is necessary is to rub 3 or more strokes of stick across pipe threads. It spreads and fills threads when turned. Encased in a convenient cardboard holder, the stick may be carried around in a pocket or tool kit, always ready for instant use.

These are the features listed for the compound: Withstands gasoline, oil, butane, Freon, air, water, steam, acid, gas brine, sulphur dioxide etc. Joints can be disconnected easily months and years after applying. Lubricates and completely seals pipe joint threads nuts, bolts, gaskets, turnbuckles, etc. Cannot flow into and clog even the smallest size pipes.

Withstands vibration, temperature changes, deflection, high pressures. Joints can be remade without having to clean the threads. Prevents rusting.

U Conveyor Trolley. Announcement has just been made by Link-Belt Co. that it is now manufacturing a free rolling conveyor trolley, described as unique for its simplicity.

The illustration shows that the two basic elements—wheel and one-piece bracket—themselves form the deep inner and outer races of the bearing. The revolving inner race is designed to distribute wear completely around the ball-path. All fixed points of pressure are on the outer race, where the large diameter provides a great area of distribution and, consequently, high resistance to wear.

Protective felt seals and adequate lubrication reservoirs are important features of the design. Wheels and brackets are drop-forged steel, with ball races accurately machined and hardened. The wheels are "coined" for roundness and freedom of rolling action.

The one-piece brackets are designed to transmit the weight of the suspended load from supporting clev-

ices to the ball bearings (as they do the load resulting from chain pull on vertical curves) without the use of intermediate elements.

Summing up the features of the trolley the manufacturer points out that it is of simple, accurate construction, good looking, long wearing, and that its streamlined design makes it practically self-cleaning. It is available for use with Link-Belt overhead trolley conveyors or it can be purchased separately.

V New Stainless Steel. The first new multiple-purpose steel since the war ended was announced recently by Carnegie-Illinois Steel Corp., a United States Steel subsidiary. Known as "Stainless 'W'" because it is a member of that family of alloy steels, the new composition belongs rather to the class of working steels and will find broad use in the industrial machines of postwar America.

TROY-ENGBERG
STEAM ENGINE

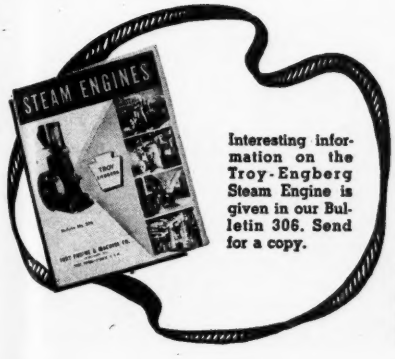
IT SURE IS *Adaptable!*

An offhand check of the sales of Troy-Engberg Steam Engines shows quite a variety of equipment being driven. For example:

exhausters
pumps
draft fans
blowers
mixers
conveyors
generators
cookers
dryers
line shafts
air compressors
refrigeration compressors
ventilating fans

Probably *economy* and *dependability* provided the first two reasons why the steam engine was selected. Other reasons, however, were influencing factors: flexibility, close speed control, high starting torque; ability to carry heavy overloads for long periods, and in the case of some process plants, explosion-proof design.

The first two reasons—economy and dependability—should interest you in connection with that drive you are planning to buy.



Interesting information on the Troy-Engberg Steam Engine is given in our Bulletin 306. Send for a copy.

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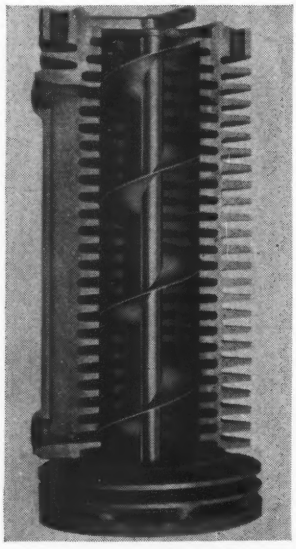
STEAM ENGINES • GENERATING SETS • GENERATORS

W Heat Exchanger. Bird-White Co. has announced the development of a new temperature exchanger based on the principle of heat transfer for air and gas lines and offering as a by-product, external heating applications and purifaction by centrifugal action.

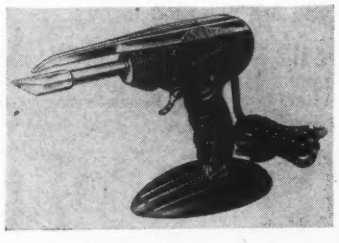
This specially designed unit, as an after-cooler, is recommended for installation at the compressor discharge point. Liberally supplied with external and internal cooling fins, the new temperature exchanger features a multiple action helicoid flighting. The velocity of the element (air or gas)



under pressure revolves the helicoid flighting at high speeds forcing the air or gas outward against the internal cooling fins.

These internal cooling fins rapidly absorb the heat generated in compression and dissipate this heat to the outside atmosphere through external cooling fins thereby lowering the element to room temperature in the length of the unit. By this cooling action vaporized moisture and oil suspended in the element condenses and is entrained in the sump, assuring a moisture-free, cooled element at the discharge point.

X Electric Soldering Iron. An automatic-feed, electric soldering iron, the new Ejec-O-Matic is being introduced by the Multi-Products Tool Co. This new



iron is trigger-operated and ejects a measured amount of solder from a reel concealed in the handle. A special retracting feature prevents the melting of excess solder on the heating tip. The actual amount of solder deposited each time the trigger is pulled is regulated by a micrometer adjusting wheel mounted in the handle of the iron easily accessible to the operator's thumb. If, during the course of a job, more, or less solder is required, a touch of the wheel changes the amount ejected. This new iron is said to be the first major advance in soldering irons in the past 25 years.

The soldering iron is of balanced construction and compactly built. The pistol-grip handle is made of molded bakelite. The tool weighs 1¼ lb loaded, and is so balanced that it can be used for hours without fatigue.

Y Wheel, Pulley Puller. The design of the Klay puller, announced by The Scott and Ewing Co., in which the pulling and gripping actions are independent of each other, is claimed to develop extreme pulling power plus a safe and positive grip on the object being pulled.

Not only does the lock nut principle securely lock the hooks to the gear or wheel so that they will not slip off, but the grip is equally applied on all sides. Thus, it is said, the total

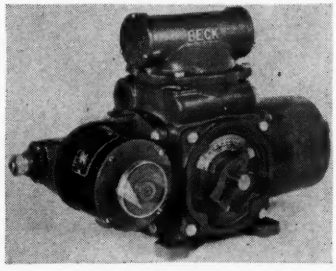
force developed by the pulling screw is directed toward removing the wheel instead of part of its being diverted into gripping power.

The Klay Puller is said to be foolproof in operation. In addition to regular straight and curved hooks, many types of special hooks are available and interchangeable for specific applications—including expansion hooks which work just the opposite from regular hooks in that they are used in pulling from the inside.

They are made in two- and three-hook types for pulling anything from a ⅝ in. gear up to a 40 in. wheel or hub.

Z Automatic Control System. The Beck Mechanism, manufactured by Harold Beck Co., is an automatic control actuator which operates valves, rheostats, auto-transformers and similar devices. It is designed to make close control possible under rapidly changing loads, to hold temperature or other conditions to an exact control point free from the drooping characteristics, and to permit operation at maximum sensitivity.

System is based on three control actions: C-1 is proportional to and opposes any change of the controlled condition within the throttling range. If this were the only control action, a return of the condition to the control point would place the regulating device in the position from which it started and, on a sustained load change, continuous hunting would re-



sult, or if the throttling range were corrected to avoid hunting the process would settle down at some value off the control point.

C-2 and C-3 are the automatic reset or droop corrections which eliminate this effect. The C-2 is the major part of the correction. It is proportional to the C-1 action, and is introduced to the system as fast but not faster than it can be absorbed. The C-3 action consists of an impulse that is periodically introduced when the system is off the control point, to move the regulating device in the proper direction to restore the system to the control point. This is a timed action and is proportional to the magnitude of the deviation. C-3 prevents the system from staying off the control point due to some unusual combination of demand change and control action.

They are used for control of gas-fired or electric furnaces, automatic reversal of regenerating furnaces, safety circuits for gas purging and in electrical testing apparatus.

Each mechanism is driven by a slow-speed, high-torque, non-coasting control motor. A non-mechanical magnetic brake is designed to assure accurate reproduction of minimum turn down and non-hunting control action without sacrificing sensitivity of the control system. The heavy motor shaft turns in grease-sealed ball bearings. It is pointed out that the armature can be stalled without damage to the mechanism and the stalled motor will not overheat.

AA Hermetically Sealed Rectifier. A newly developed selenium rectifier can be submerged in boiling water or packed in ice and still turn alternating current into direct current at an efficiency equal to that obtained under normal operating conditions, it is announced by the manufacturer, Westinghouse Elec. Corp.

The new rectifier consists of a heavily tin-plated, hermetically-sealed container inside which is placed selenium suspended in oil.

Many unfortunate experiences on battlefronts occurred when a converting device failed to operate while exposed to heat which mounted as high as 150 F, or to cold far below zero. Motors, relays, signal lamps, controls and most important of all, radio and radar quit working. Frequently the

If you BUY or Use GASKETS you'll want this File-worthy new U. S. Gasket catalog

Purchasing agents, engineers, operating men—everyone who purchases, specifies, or uses Gaskets—should have this important U. S. Gasket Catalog, No. 303, at hand for quick, easy-to-use reference.

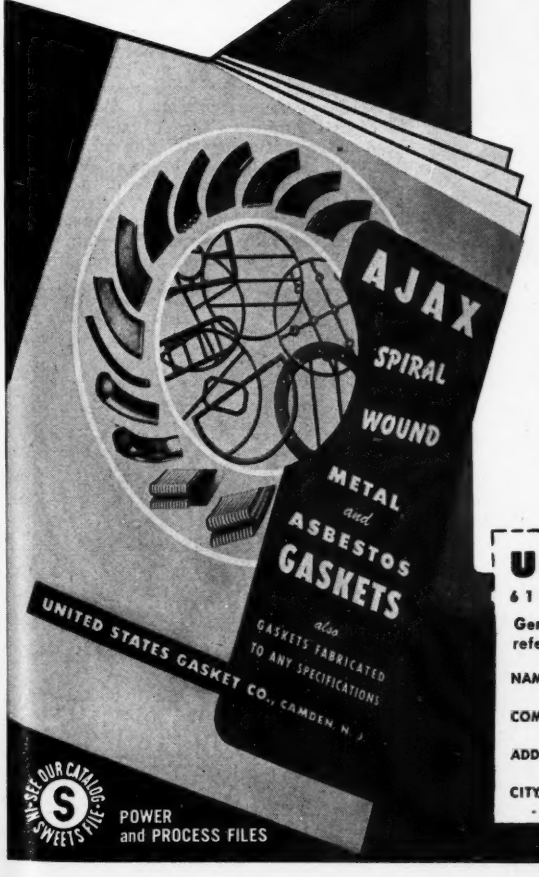
No matter what kind of Gaskets you use—high or low pressure, marine or industrial, from AJAX Spiral Wound Metal-Asbestos to die-cut cork sheet, U. S. Gasket makes them and the new catalog has full information about them.

Catalog No. 303 is designed for use: its material is arranged to give you the greatest possible assistance in selecting and ordering the RIGHT Gaskets for your particular requirements.

Detailed data on sizes, materials, temperature and pressure ranges, bolt stresses, etc., is presented in clear, concise, tabular form. Pertinent engineering reference tables are included for your convenience.

Special sheets have been prepared to facilitate your orders or inquiries, showing drawings of basic flange types with dimensions carefully keyed to reduce your time and effort to a minimum.

Send the coupon for your copy of this valuable bulletin—today!



UNITED STATES GASKET CO.
610 N. 10TH STREET • CAMDEN, NEW JERSEY

Gentlemen: I'd like to have a copy of your new Gasket Catalog, No. 303, for my reference files.

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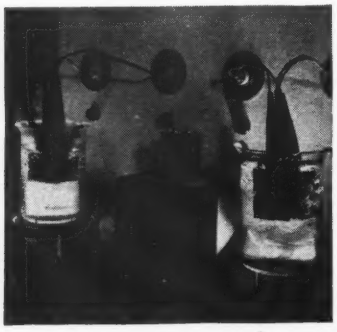
CITY_____ ZONE NO._____ STATE_____

rectifiers were ruined and had to be replaced.

Industrial electrical control devices; transformers, res stors, vacuum tubes, rectifiers and other heat-dissipating apparatus, are usually mounted inside a metal cabinet resulting in extremely high temperatures that tend to lower efficiencies and long



life for ordinary rectificers. This new selenium rectifier, it is pointed out, will operate with only a slight drop in current output at a total temperature higher than the boiling point of water and will last much in excess of 1,000 hr.

BB Welding Electrodes. Metal & Thermit Corp. announces the addition of two entirely new groups of high tensile arc welding electrodes.

These new electrodes, it is claimed, provide two complete series of all-position high tensile electrodes; one having an AWS-ASTM XX10 type of coating and the other a coating of the AWS-ASTM XX13 variety. Individually, there are eight electrodes in all, one classified as AWS Grade E-7010, one E-8010. one E-9010 and one E-10010, all for use on direct current with reverse polarity, and a companion electrode to each having an XX13 coating for use on alternating current or on direct current with straight polarity.

Developed to meet the requirements of fabricators of power plant piping and equipment. but applicable to a variety of welding applications involving high tensile steels. these new electrodes provide a wide range of mechanical properties and make it possible to select weld metal very closely matching many high strength steels in tensile strength and ductility. In addition, the all-position feature and the two types of coating provide versatility to meet a variety of working conditions.

CC New Gasketing. An improved type of gasketing is announced by the Products Research Co. -It is called Chrome Lock. Like a good many other items developed as substitute for scarce materials during the war. this gasketing was introduced to shipbuilding as a substitute for rubber and other critical gaskteing materials.

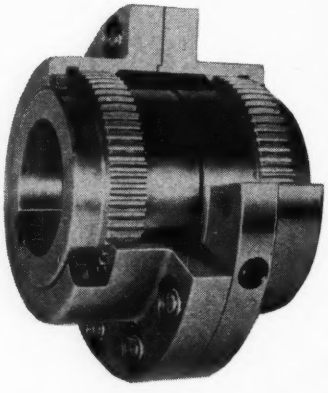
Among the advantages claimed by the manufacturers for this product are: flame resistance, fuel resistance, rust-inhibition. anti-wicking, lamination, non-oxidation. non-hydroscopic, compressibility, long life, cushioning, ease of handling.

The Company points out that its ease of handling is largely brought about by the fact that gasketing has an adhesive back. It can be fingerpressed onto the surface and, it is claimed, will "stay put." They have a crinolin liner upon which the template may be laid and either scribed or or marked with an ordinary lead pencil. Quantities of gaskets may be cut at one time and with the liner left in place, stacked in parts bins without danger of sticking together or collecting dirt and filings. The liner also serves to stabilize the gasketing during the cutting operation.

Chrome Lock Gasketing is supplied in four types, Nos. 8 and 16 without the adhesive back and Nos. 8A and 16A with adhesive back. The gasketing is packed in both rolls and slit rolls.

DD New Coupling. The Coupling Division of John Waldron Corp. announces that a new "Series A" coupling has been designed for a much larger maximum bore to permit use of smaller sized couplings than would ordinarily be required. The smaller size coupling is described as taking up less space, needing less shaft extension and looking better.

It retains the construction features that have always been basic in Waldron couplings; all steel, made to



close manufacturing tolerances, dust proof, oil tight, identical externally geared hubs that key to shafts, enclosed by one piece male and female sleeves that function as a single rigid unit. The "Series A" coupling is designed to compensate for misalignment without adding stress to shaft or bearings.

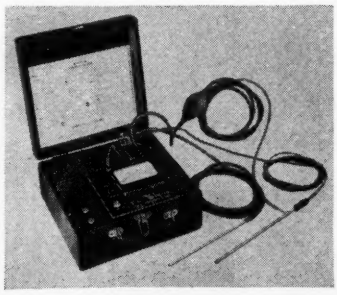
These couplings are made in standard, heavy duty, marine, mill motor, floating shaft, Jordan, shear pin, oil collector and cut-out types.

EE Stack Analysis Instrument. The Davis Emergency Equipment Co. announces a new small portable instrument, known as the Stack-O-Meter, for indicating CO_2 stack temperature and draft readings.

Among the features of the new instrument is the fact that all readings are taken on one meter. CO_2 percentage readings are obtained from gas samples collected thru a hand aspirator bulb. Stack temperatures are read on the same dial, obtained electrically from a thermocouple mounted in the gas sampling tube. Draft measurement is obtained thru a separate tube, but read on the same meter.

The meter dial reads 0 to 20 per cent CO_2 in black figures, temperature on a red scale 0 to 1000 F and draft in tenths of inches of water on a green scale.

An exclusive feature is a safety switch which automatically shuts off



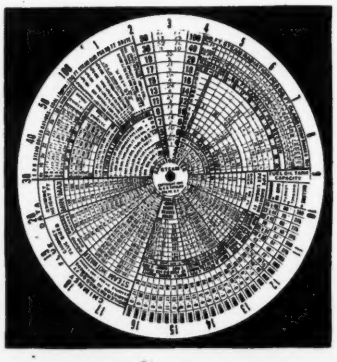
battery current on closing the cover of the instrument box.

Complete portability is obtained by having sampling hose, hand aspirator, thermocouple sampling and draft sampling tubes all located in the one case. Case is 12 in. x 13 in. x 5 in. Weight of case with complete instrument is 11 lb.

Electrically operated, the only maintenance is that of an occasional replacement of batteries, which are of the standard flashlight type, easily obtainable.

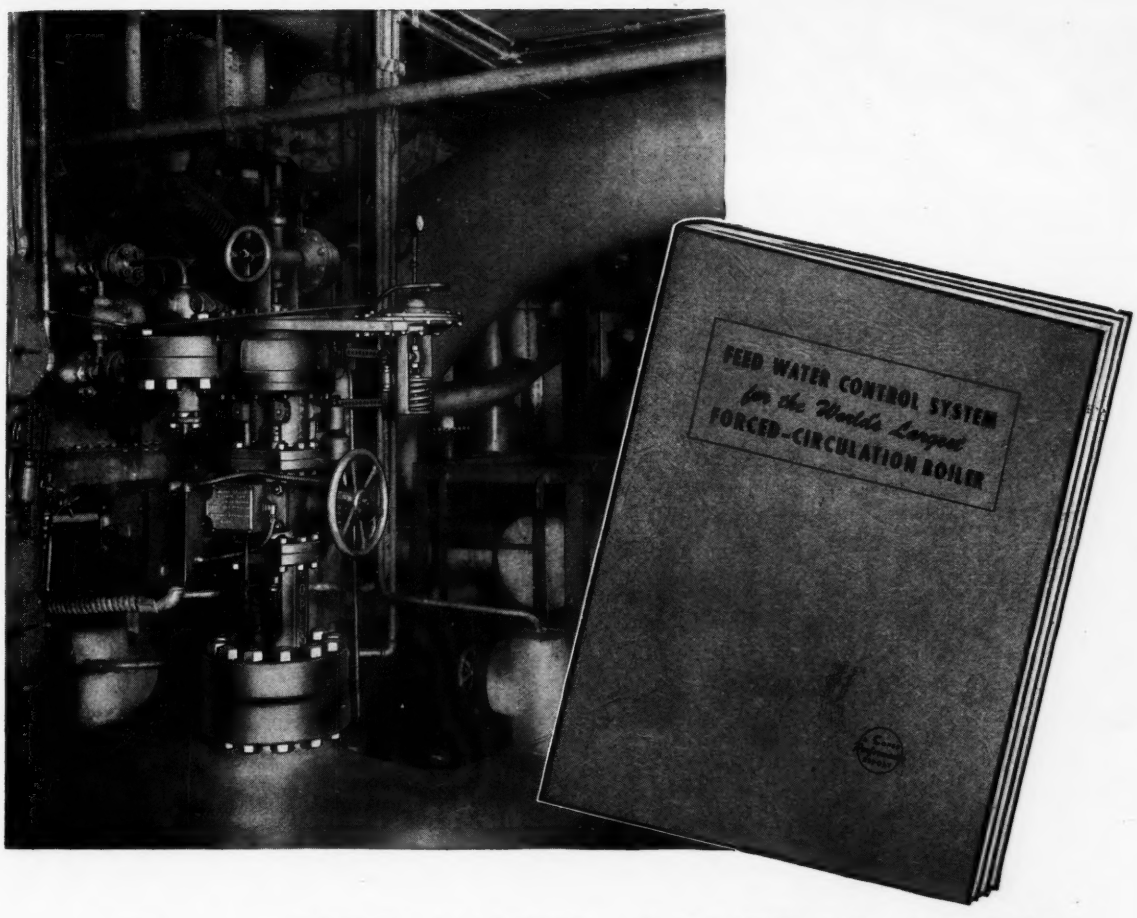
FF Radiation Calculator. A new calculating device for measuring radiation for steam and hot water heating systems has been announced by Heat-O-meter.

It is claimed this new calculating device (physically a round dial with three concentric celluloid printed discs) eliminates the tedious figuring, usually necessary to determine the correct amount of radiation, and can be used by anyone without previous technical training as its operation is rapid, not involving subtractions, divisions, complicated multiplication, nor the use of a formula. Just the simple



turning of a dial and the correct answer is received.

It is also stated that this dial contains sizes of mains, returns, risers, radiator sizes and capacities, round and sectional boiler net ratings, chimney flue sizes and capacities with minimum and maximum heights, hot water tank sizes and capacities, fuel oil tank sizes and capacities, hot water generator capacities and other valuable heating information.



A COPES *Performance* REPORT

FEED WATER CONTROL SYSTEM *for the World's Largest* FORCED-CIRCULATION BOILER

Here is the story of the feed water control developed by COPES for the world's largest forced-circulation boiler at Somerset Station, Montaup Electric Company. Charts show the close stabilization of water level under base-, regulating- and emergency-load conditions. Write for Bulletin 447.

NORTHERN EQUIPMENT COMPANY

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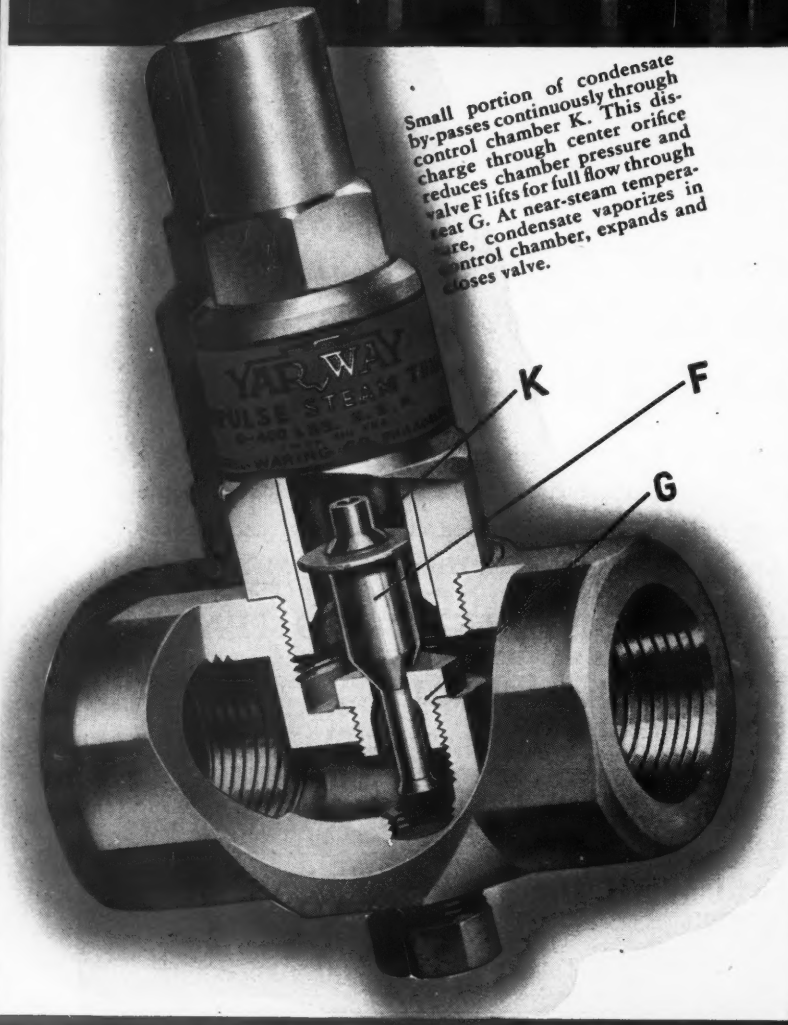
COPES FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

★ GET CLOSER LEVEL CONTROL WITH THE FLOWMATIC ★ REGULATOR

Six LITTLE TRAPS and How They Work!



Small portion of condensate by-passes continuously through control chamber K. This discharge through center orifice reduces chamber pressure and valve F lifts for full flow through seat G. At near-steam temperature, condensate vaporizes in control chamber, expands and closes valve.

Six Yarway Impulse Steam Traps—doing a big job draining condensate from a battery of autoclaves used for experimental extraction of tanning materials. They are typical of the two hundred Yarway Traps installed on a variety of steam equipment at the big Eastern Regional Research Laboratory of the United States Department of Agriculture.

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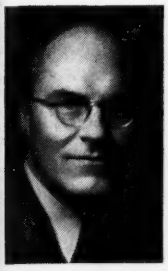
YARWAY IMPULSE STEAM TRAP

WHAT LEADERS SAY—

Are We Winning the Peace?

By DAVID C. PRINCE



NOW THAT the war is over, we appear to be losing the peace, both at home and abroad, all on account of our failure to fix our minds upon a goal and then devote all our energy and ability to its realization.

Nevertheless, in spite of the rather discouraging world picture, our economy of plenty is not lost. In fact, there seems to be every probability that we can more than realize the domestic goals which were visualized five years ago.

Chart 1 is reproduced from a talk presented before the Edison Electric Institute in June of 1941. In those days we talked about the defense program and about post-defense national income. The post-defense year, you will note, was selected as 1946. This is 1946! The gross national product was estimated at 110 billion dollars, at 1940 prices, of course. Giving effect to the increased price and wage level brought about by the war-induced inflation, this 110 billion may yet represent very closely the gross national product which will be realized in 1946.

Our year 1943 on the chart obviously falls far short of the actual realization because, with the onset of war, our production efforts were very greatly intensified. Our year 1946, however, appears to be an excellent justification for the method of forecasting used.

In 1941 certain economists were saying that we had reached a mature economy, from which the conclusion was drawn that the country could not expect to maintain high levels of employment without deficit spending by the government — or, alternatively, without increasing the ratio between wages and prices so that the worker would be able to buy a larger fraction of his output.

The war has, at least temporarily, completely altered that picture. For the next several years the rebuilding of our factories and making good the tremendous deficit in housing will absorb all the savings that are made, so that there need be no fear of unemployment from that cause.

Subsequent to the preparation of Chart 1, the Committee for Economic Development came into being. That Committee inspired Mr. S. Morris Livingston, of the Bureau of Foreign and Domestic Commerce, to make a similar analysis which appeared in considerable detail as "Markets After the War," published by the C. E. D. in 1943. "Markets After the War" also undertook to forecast by statistical methods a postwar year. Again, the year selected was 1946. Mr. Livingston also assumed a price level and came out with the expectation of a gross national product of 165 billion dollars.

The Committee for Economic Development organized business men in a large number of communities in the interests of high level postwar employment. This activity resulted in a rate of conversion from war to peace far higher than would otherwise have been possible and prevented the accumulation of the large masses of unemployment freely predicted prior to the end of the war.

The Committee for Economic Development also conducted a very extensive survey of manufacturers, seeking estimates of probable postwar business, and issued the publication "American Industry Looks Ahead" almost coincident with V-J Day, indicating a gross national product for 1947 of approximately 153 billion. The selection of 1947 in that case was based upon the fact that at the time the figures were made the war was still in progress. Since the war ended in time for a reasonable

(Continued on page 120)

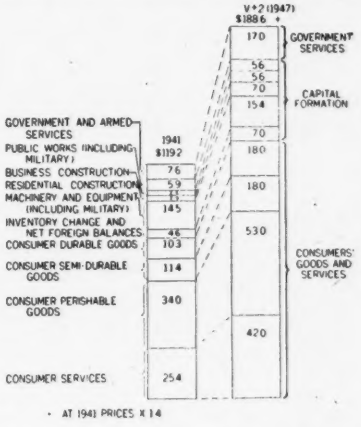


Chart 2. Gross national product (billions of dollars) based on author's and CED methods, showing breakdown similar to Chart 1

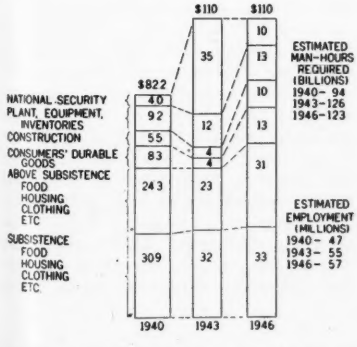


Chart 1. Division of gross national output (billions of dollars) as estimated in 1941

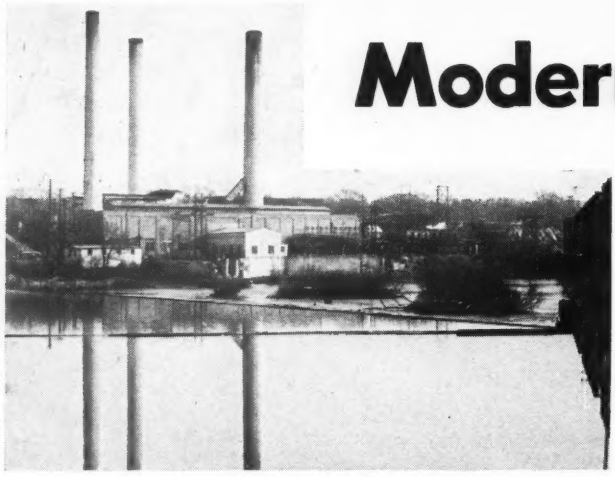
David C. Prince is vice-president of General Electric Co. in charge of the General Engineering and Consulting Laboratory at Schenectady, N. Y. He was graduated with honors from the University of Illinois in 1912 with the degree of B.S. in electrical engineering, received his M.S. degree the following year. He then joined the GE test course. From 1914 to 1917 he was with the Public Utilities Commission of Illinois and from 1917 to 1919 served as a first lieutenant in the Army Ordnance Department attached to the Air Service in Paris. Returning to GE after the war he has served the company continuously in many capacities since that time.

He was on the staff of the Research laboratory in 1923; was research engineer of the switchgear department in Philadelphia in 1929 and head of the entire department in 1931. In 1940 he was appointed commercial engineer for the entire company and in 1941 was elected a vice-president in charge of application engineering for the Apparatus Department. He was named to his present post in March, 1945.

Mr. Prince is the author of many important technical papers, has to his credit 89 U. S. patents, has made very important contributions to development of oil and air blast circuit breakers, mercury-arc and electronic rectifiers, inverters for high voltage d-c transmission. He served as president of AIEE in 1941-42, is a member of ASME, IRE and many other societies.

He has been especially active in groups planning for peace-time developments. He was vice-chairman of the Field Development Division of the Committee for Economic Development and has headed many other committees engaged in that work. It was from this intimate knowledge of the trends in post-war planning and the progress of industry in general that he addressed the recent Midwest Power Conference in Chicago on April 4, 1946. From that address the above comments were extracted.

Modernizing Rockford



By W. E. Hopkins,
Mechanical Engineer, Stone & Webster Engineering Corp., and

R. S. Kibler,
Chief Engineer, Central Illinois Electric & Gas Co.

Fig. 1. General view of Rockford Station

ENLARGEMENT and modernization of the Rockford Generating Station of the Central Illinois Electric and Gas Co. is now underway to permit the utility system to meet its own electric light and power demands without dependence on the tie line with a neighboring utility company, which has heretofore furnished power for part of the load. The Rockford Division of the Central Illinois Electric and Gas Co. serves an area centered on the city of Rockford, which is about 75 miles slightly north of west of Chicago and is the center of a thriving industrial section in Northern Illinois.

The plant is strategically located near the center of the city of Rockford, Illinois, on the Rock River. The original plant was constructed about 1890 and consisted of steam engine generators and horizontal waterwheel generators. The waterwheels were replaced with vertical hydraulic turbines in 1924, and the last of the steam engine generators was removed in 1941 to make way for the first of the two new 20,000-kw steam turbine generating units that are now being installed.

Development

The current project was started before the outbreak of war, was halted in 1942 by government restrictions and was started anew on an enlarged basis in the last half of 1944.

Engineering studies indicated that since all existing turbine generator units are over 18 years of age, long term plans should provide for their relegation to stand-by service by the addition of three 20,000-kw units, except that the small noncondensing unit would continue to be used in the winter to supply district heating steam.

It was intended that this new plant expansion would take place in three steps, each consisting of one 20,000-kw unit complete with boiler and accessories.

Because of the delay caused by the war in completion of the first step, both the first and second steps are being undertaken concurrently and it is now possible that the third step may be started earlier than 1949, as originally planned. The third unit will replace the present 8000-kw, 4000-v condensing unit.

Selection of 20,000-kw units was based on the character of the system load, width of the existing turbine room and load now carried by the high tension tie line which has a practical capacity of about 20,000 kw.

Existing Plant

The plant site as it appeared before commencement of work on the present extension is shown on Figs. 1 and 2.

The existing electric generating equipment consists of a 6250-kw, 4000-v straight condensing unit in good condition, an 8000-kw, 4000-v straight condensing unit of questionable reliability to be replaced by the third 20,000 kw unit, a 4000-kw, 4000-v, 15-lb back pressure unit exhausting to the district heating system, a 15,000-kw, 13,800-v straight condensing unit in continuous operation and two 600-kw hydroelectric generating units operated within narrow storage level variations permitted above dam. The rated capacity of the above electric generating equipment now in service totals 34,450 kw. Actually, the full capability of the present Rockford Generating Station (33,750 kw) plus the capacity of the interconnection with a neighboring utility company, as determined by physical limitations (20,000 kw), is within about 1000 kw of the system peak loads.

The total steam generating capacity of the existing six boilers is 660,000 lb per hr at a pressure of 250 psi gage. Boiler No. 10 was installed in 1940 and is pulverized coal fired, slag tap type with rated capacity of 175,000 lb per hr. All other boilers are chain or traveling grate fired,

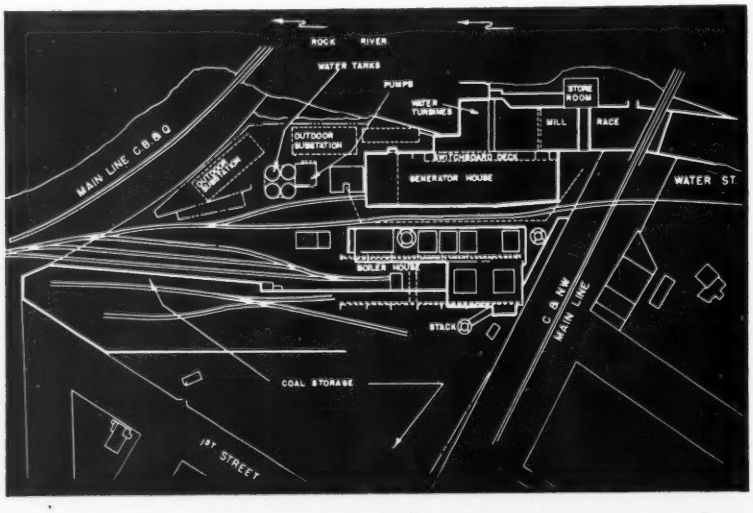


Fig. 2. Plan of plant site before enlargement showing the relation of the various plant units to the railroads and river

Illinois, Generating Station

Old station built in 1890 is being extended by the addition of two 20,000 kw generating units. Project involves the installation of two steam generators each with a peak capacity of 215,000 lb per hr, equipped with spreader stokers. This modernization project was started before war but was halted in 1942 by government restrictions. Basis of design for additional units is discussed; steam conditions to be 650 psi, 825 F at turbine throttle. Coal handling system involves interesting layout problems; includes shuttle conveyor. List of principal added equipment

the largest having a maximum steam generating capacity of 200,000 lb per hr.

There is a deficiency of about 50,000 lb per hr in the firm steam generating capacity of the boiler plant compared with the steam requirements of the existing electric generating equipment.

The area available for the plant is already congested and the present extension of the plant is toward the coal yard and electric switching facilities. The boiler room extension encroaches on space now used for coal storage and trackage and makes it necessary to rearrange the yard trackage layout. The turbine room extension requires relocation of numerous electric cables and ducts which have been in service many years.

General Arrangement

By reference to the plan for the development of the station, as indicated by Fig. 3, it will be noted that the boiler and turbine rooms are separated by a railroad branch line. Plans and cross sections of the boiler and turbine rooms are shown on Figs. 4, 5, and 6.

Use is being made of the existing building to house the turbine generators. The space available is indicated by Fig. 7. Some extension of the present building is necessary and this will continue the existing construction of steel frame and brick walls. The foundations will rest on sand and gravel. The new generating units require a deep basement which makes it necessary to underpin the walls of the existing structure. This is a difficult operation due to the proximity of electric cables along the west wall, the railroad track along the east wall and the fact that the basement will be about 20 ft below high water level in the adjacent tailrace.

Similar construction will be used in the extension of the boiler room. Advantage has been taken of the hillside location of the plant to place the air heater, cinder collector and fans to the rear of each boiler. Although this arrangement reduces the height of the building and improves convenience in operation and maintenance, there is some increase in the floor space requirements.

The new equipment will consist primarily of two 190,000 lb per hr steam generating units and two 20,000 kw turbine generators. Steam conditions are 650 psi gage, 825 F at the turbine throttle. It is expected that the existing boiler No. 10 will be raised from 250 psi to 675 psi pressure operation to improve the availability of the high pressure steam supply. Thus, when the third 190,000 lb per hr boiler and the third 20,000 kw turbine generator are later installed, there will be four high pressure boilers to supply three turbine generators which would permit some outage of the boiler equipment as might be expected when burning midwest coals.

All boiler equipment is designed to burn Fulton County, Illinois, coal having an ash softening temperature of about 1950 F, a heat content of 10,600 Btu, 11 per cent ash and 15 per cent moisture. Space is being provided in the new boiler layout for the possible future burning of gas from southwestern fields.

A completely new coal handling system of the belt conveyor type is being provided for the entire plant to replace an elevator and scraper conveyor system which required three shift operation. Ashes will be removed dry by a pneumatic conveyor system. No new water treating

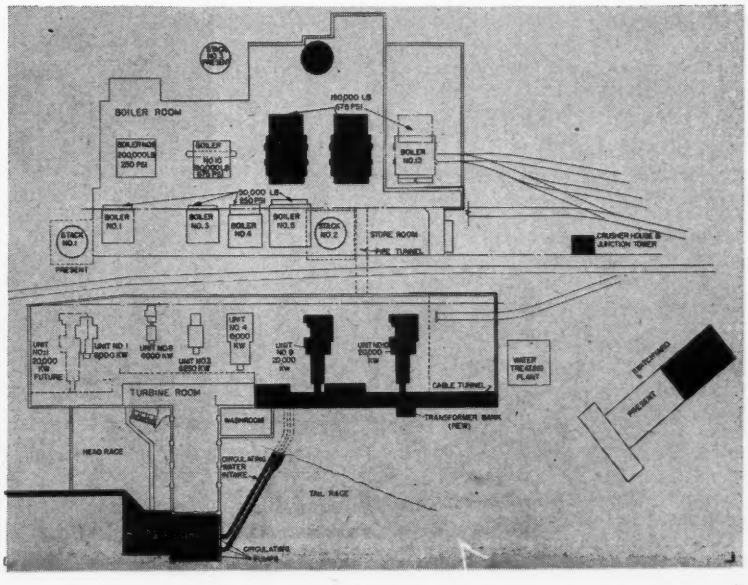


Fig. 3. Proposed power plant extension showing new boilers and turbines. (Colored blocks indicate the additions)

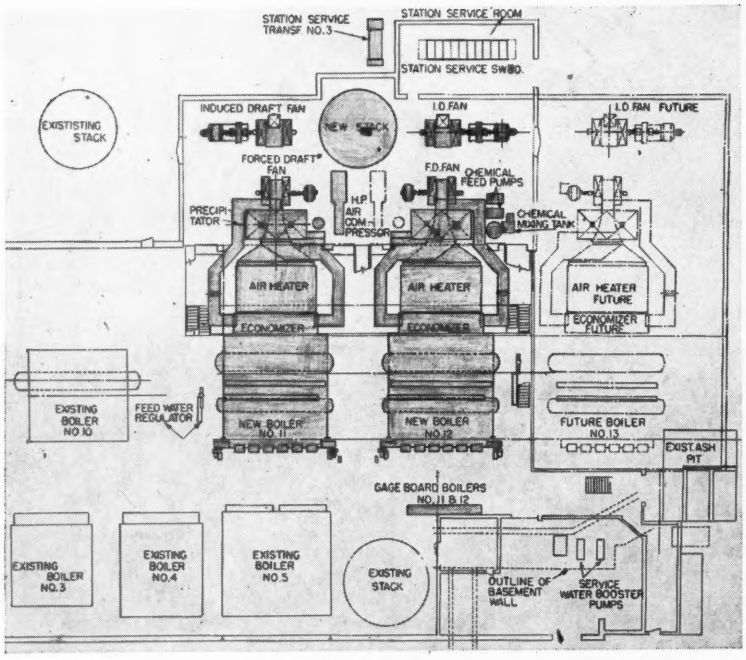


Fig. 4. Plan of boiler room extension. Shaded equipment is that now being installed

facilities are required as the make-up requirements of the plant extension are insignificant compared with facilities installed for make-up of losses in the existing district heating system.

All new auxiliaries are motor driven, except for a stand-by turbine driven boiler feed pump.

Steam Generating Units

The two steam generating units are of the three-drum bent tube, Foster Wheeler type, each designed for a maximum continuous output of 190,000 lb of steam per hr and a four-hour peak output of 215,000 lb per hr at 675 psi gage and 830 F at the superheater outlet when supplied with 340 F feedwater. The boilers are fired by Detroit Roto Grate spreader stokers and are equipped with superheater, economizer and air preheater. A longitudinal sectional view of the boiler and related equipment is shown by Fig. 8.

The superheaters are of the four loop pendent type and are equipped with a surface condenser in the superheater inlet header for automatic control of steam temperature at the superheater outlet for loads above 130,000 lb per hr steam generation. A diagram of the superheat control arrangement is shown by Fig. 9.

In view of the moderate temperature, about 280 F, of the air to the stoker and the reasonably high boiler pressure, it was found economical to install an economizer as well as an air preheater. The economizer is the extended surface type and the air preheater is the vertical tubular type constructed in two sections.

Considerable investigation was made as to the method of coal firing best suited for the plant which will operate as an isolated station burning midwest coals to meet widely varying station loads. Spreader stokers of the continuous ash discharge type were selected because of the lower investment and operating cost when consideration was given not only to the purchase price but also such factors as auxiliary power, maintenance, slagging, foundations and electrical facilities. The stokers are being furnished by the Detroit Stoker Company and are their Rotograte design having six coal feeders, six coal hoppers, a cinder reinjection system and overfire air apparatus. The coal and air supply as well as the stoker units are divided into two sections to permit generation of about 70 per cent rated steam output with one section idle for emergency repairs.

The furnaces will be rectangular, about 24 ft wide by 15 ft deep, with straight water cooled walls except that the pier and arch section of the front wall at the stoker feeders will be air cooled. The piers will be constructed of hard burned tile of "Maximull" refractory furnished by M. H. Detrick Co. The boiler settings will be erected by Ballard & Sprague using LaClade Christy refractories.

Manual steam soot blowers will be furnished by Vulcan Soot Blower Corp. for the boilers and economizers as expectations are that little soot blowing will be required. The two long type air motored, retractable blowers will be installed for each superheater. A 250 cfm, 350 psi gage air compressor will supply compressed air to air-puff type, automatic soot blowers for cleaning the cold half of the air preheaters. Provision has been made for future installation of a duplicate high pressure compressor and receiver in case usage of the blowers becomes sufficiently frequent to justify automatic sequential operation. An aftercooler has been provided and the piping layout has been arranged to minimize danger of explosion in the high pressure air system.

Draft System

Each boiler will be served by one American Blower constant speed, double inlet, motor driven forced draft fan and one American Blower

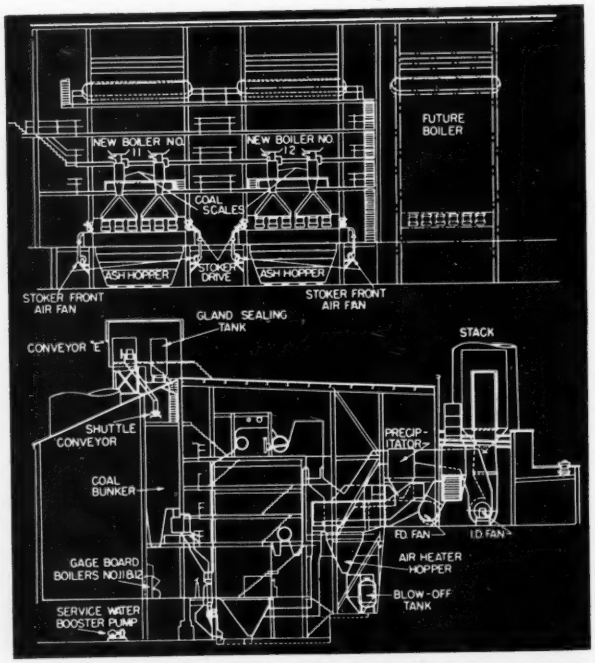
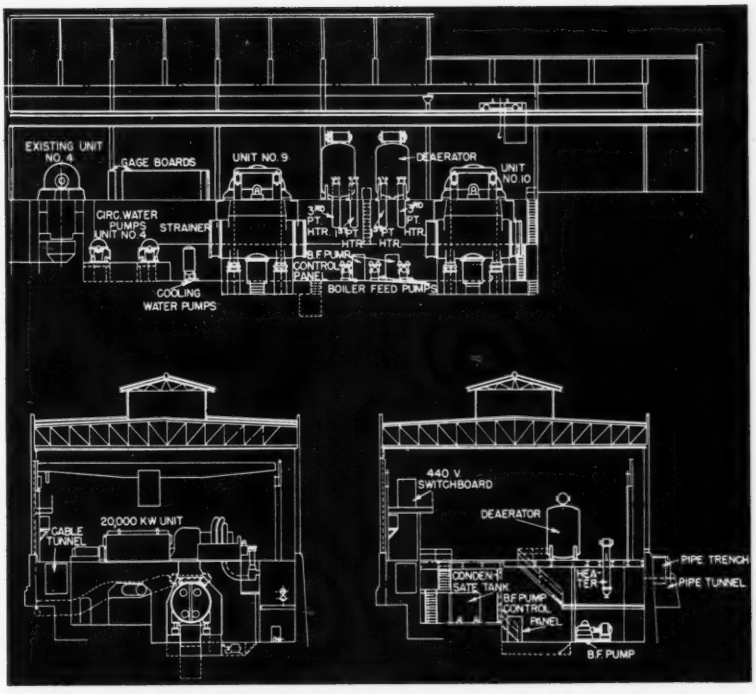


Fig. 5. Section of new boiler room showing two new boilers, location of fans, air preheater, precipitator, control board and other auxiliaries

Fig. 6. Sections of extended turbine room showing the location of new turbine generator units and auxiliaries



variable speed, double inlet, motor driven induced draft fan. The induced draft fans will be driven through Electric Machinery Co. magnetic couplings controlled by 100 step rheostats from the Hagan combustion control system. Inlet damper control will be provided for the forced draft fans.

Air will normally flow to each forced draft fan through two inlet ducts extending through the fan room roof. Tempering air heaters will be located in each inlet duct for the purpose of automatically raising the inlet air temperature when the out-of-door air is below 60 F. The lowest temperature on record at Rockford is minus 26 F and the highest is 110 F. Provision will be made so that air can be drawn from the fan room to promote comfort in the boiler room.

A cold air by-pass will be installed around the air preheater for possible lowering of the temperature of the air to the stoker when burning unusual coals. A damper in the by-pass will automatically open in case the temperature of flue gases leaving the air preheater falls to 250 F as may occur at light boiler loads.

A recirculating air duct with suitable dampers and control apparatus will be supplied to automatically maintain the temperature of the air entering the air preheater at temperatures predetermined to reduce corrosion of the preheater tubes.

Air leaving each air preheater will pass to the two stoker air plenum chambers required for each boiler. Air for the motor driven cinder reinjection fan will be taken from the hot air duct between the preheater and the stoker plenum chamber.

Gases leaving the boiler will pass through the economizer, to the air preheater, to a cinder collector and then to the induced draft fan which will discharge the gases into a new 14 ft diameter by 232 ft high reinforced concrete brick lined chimney.

The cinder collector equipment will be of the dry, multicyclone, tubular type made by Western Precipitation and will be equipped with motor driven rotary valves for discharging collected cinders to the cinder reinjection system. Normally, cinders will be disposed of by the ash handling system and the rotary valves will not be in operation.

The existing Hagan pneumatic type combustion control system will be extended to the new boilers. Two Pennsylvania nonlubricated type air compressors will be installed to provide sufficient instrument air for all high pressure boilers, including the proposed future unit.

As indicated by Figure 10, the Hagan system has been adapted to: (1) maintain a predetermined rela-

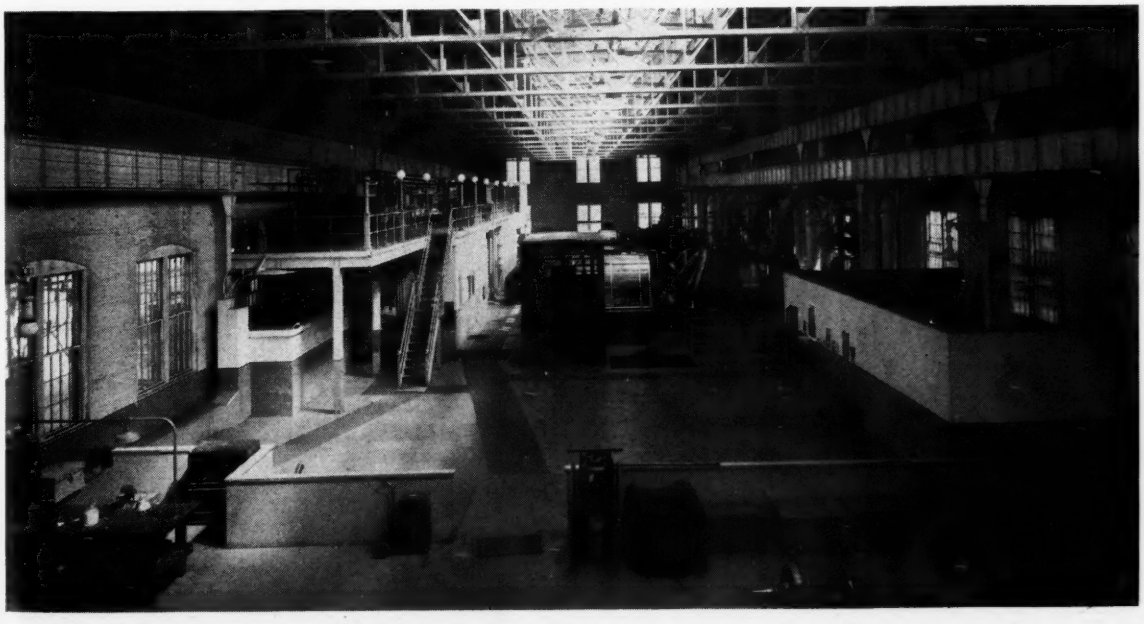


Fig. 7. View of space available in turbine room and showing location for the soon-to-be-installed Number 9 unit

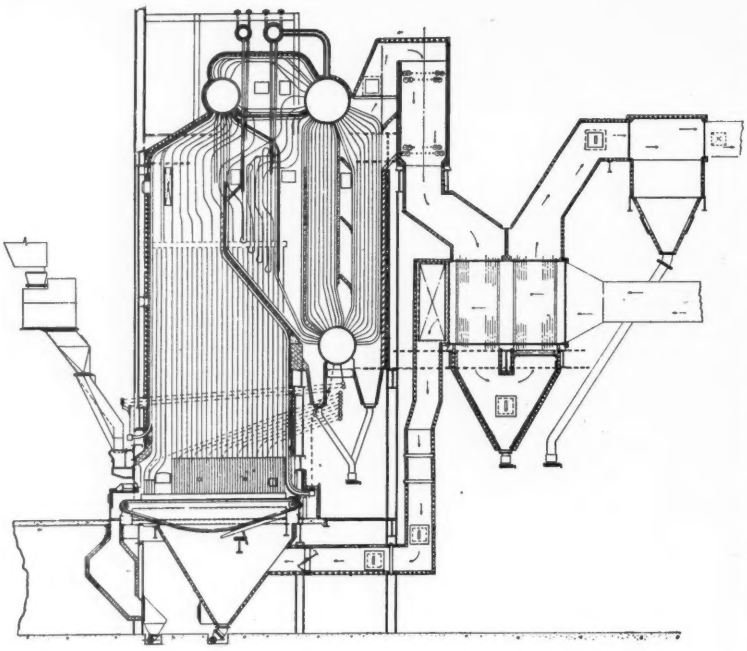


Fig. 8. Longitudinal sectional view of steam generating unit and related equipment

tionship between fuel and air in accordance with measurements of steam output and air flow, (2) limit temperature of gases leaving air preheater to safe minimum value, (3) control recirculation of preheater air through the forced draft fan in accordance with boiler load and temperature of air drawn from out-of-doors, and with provision for limiting the total recirculation to prevent starving of the boiler.

Coal Handling Equipment

The coal handling system presented several involved but interesting problems. The existing coal handling system consisting of a track hopper with feeder, a single roll crusher with bypass delivering to the boot of a double strand bucket elevator which in turn delivered to a double strand flight conveyor over the bunker, was to be removed and replaced by a complete belt conveyor system. As indicated by Fig. 11, the existing system was supplemented by an overhead traveling crane equipped with clam shell bucket which spanned an area at the north end of the car yard for digging coal directly from the cars and delivering to the bunkers through hatchways in the roof. This unit was also to be removed from the house coaling system and relocated in the yard for reclaiming from storage or to assist in discharging frozen cars.

The importance of good yard facilities was kept in mind but this at first looked like an impossible task. The yard track system consisted of several tracks fanning from switches at the north end of the yard and served by a gasoline yard locomotive which was housed on a track forming a handle to the fan. The extreme east track was equipped with a track scale.

As previously stated the current extension program provided for two new boilers, Nos. 11 and 12, and the ultimate extension would involve one more boiler, No. 13. These extensions were all in a southerly direction and encroached on an appreciable area at the north end of the coal yard. The first step, boiler No. 11, would eliminate the locomotive house, the second step, boiler No. 12, would eliminate practically all of the switches and in the future, boiler No. 13 would eliminate the track hopper.

It was quite evident that the track system would have to be revamped and the new conveyor system installed before much work could be done in the area of boiler No. 11, as this would interfere with locomotive operation and cripple car handling.

The existing conveyor system had to be kept in full operation to keep the station running and it was desirable to keep the crane operating also until the new system could be placed in service.

Several study layouts were made. The conventional arrangement of inclined conveyor approaching the south end of the station and having a horizontal section with traveling tripper over the bunkers was not practical because it placed the track hopper too far south and the tripper required too much space. It developed that a shuttle conveyor could be installed between the flight conveyor and the crane without interfering with their operation. Furthermore, this would advance the head of the inclined conveyor north to the middle of the line of bunkers which improved the track hopper location. The inclined conveyor was located to the west of the crane runway so that it would not interfere with crane operation and the head chute crossed above the runway rail for delivering to the shuttle so that the only part of the new system that could not be installed without interfering with operation was a small section of chute above the crane rail.

The track system had been almost eliminated but by close cooperation with the railroad engineers and by obtaining easement on dormant right of way areas adjacent to the yard, a track arrangement was obtained having sufficient capacity for a full day's supply of cars, whereas it had previously required two deliveries.

The layout as finally adopted and installed is shown by Figure 12.

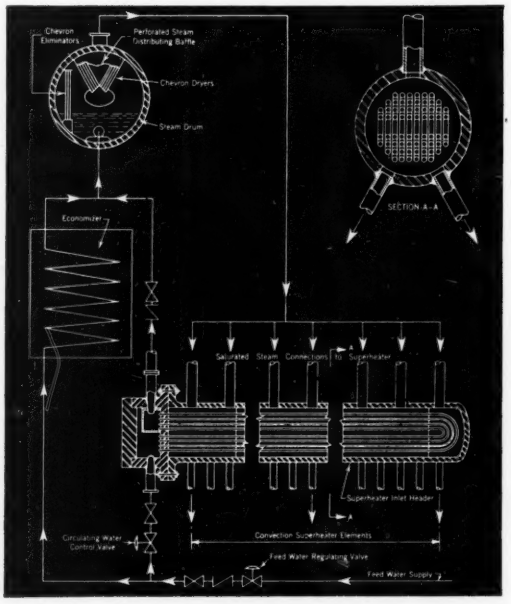
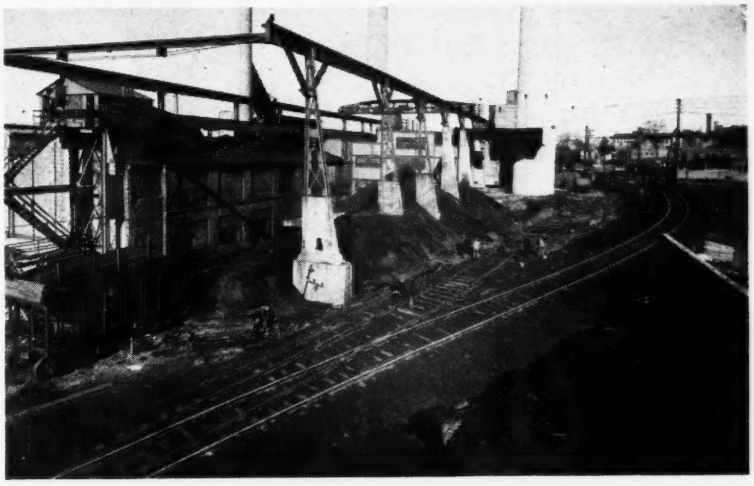


Fig. 9. Diagram of superheat control. The superheaters are of the four loop pendent type and are equipped with a surface condenser for control of steam temperature

Fig. 11. View of existing coal handling layout



Ash Disposal System

Of particular interest because of its effect on the location of the boiler heat traps and the cinder collector is the cinder reinjection and ash disposal system shown on Figure 13. The equipment is being furnished by the United Conveyor Corp.

The boilers are designed to obtain good drainage of cinders from the second and third passes. The tubular air heater hoppers have been made large to aid the collection of cinders thrown out as the flue gases reverse their flow to enter the last half of heater tube bank. Cinders drained from the second and third boiler passes and the air heater are reinjected through the furnace rear wall with high pressure air to create turbulence in the furnace.

The Western Precipitation cinder collectors have been elevated to secure gravity flow of the cinders either to the reinjection system through a motor operated rotary type air lock feeder or to ash collecting bins that are under the same negative air pressure as the cinder collector hoppers.

The Detroit Roto Grate spreader stokers discharge ash in a dry granular state and the major portion of the ash will drop from the front end of the stoker into two ash hoppers having a 12-hour storage capacity. All ash will be handled dry and will be removed pneumatically by an exhauster. All ash doors and intakes will have dust-tight enclosures.

Note: This completes the description of that part of the project involving the steam generating and associated auxiliary equipment. In the second part of this article to be presented in the August issue, the authors will take up the turbogenerator installation, the condenser circulating water and the boiler feedwater systems and the electrical system.

List of Principal Equipment
1945 Extension—Rockford Generating Station

Boilers (2)

Three-drum, bent-tube type with water cooled furnace; 190,000 lb per hr maximum continuous evaporation; 215,000 lb per 4-hr peak evaporation; design pressure 725 psi gage in boiler drum.

Operating conditions, 687 psi in boiler drum, 675 psi 830 F at superheater outlet with feedwater at 340 F.

Heating surface—16,060 sq ft. Furnace —24 ft 1½ in. wide by 15 ft 0 in. deep.—Foster Wheeler Corp.

Soot blowers furnished by Vulcan Soot Blower Corp.

Superheaters (2)

Four loop pendent type to raise temperature of steam to 830 F at 675 psi at all ratings from 130,000 to 215,000 lb per hr. Temperature controlled by use of surface condenser in superheater inlet header with feedwater which by-passes economizer used as coolant. Heating surface 3890 sq ft. 1½ loops of 4 to 6 per cent molybdenum stabilizer—2½ loops carbon steel.—Foster Wheeler Corp.

Economizers (2)

Extended surface type, U-bend tubes; heating surface 9600 sq ft.—Foster Wheeler Corp.

Air Preheaters (2)

Vertical tubular type, two sections, with cold air by-pass and hot gas recirculation; heating surface 18,000 sq ft.—Foster Wheeler Corp.

Fans-Induced Draft (2)

"Sirocco" fans each having a capacity of 119,200 cfm at 324 F against a static pressure of 17.6 in. w.g. when running at 855 rpm.—American Blower Co.

Magnetic coupling speed control, 100-step rheostat. — Electric Machinery Mfg. Co.

Drive—500 hp, 3 phases, 440 v, 900 rpm induction motors.—Westinghouse Electric Corp.

Fans-Forced (2)

"Sirocco" fans each having a capacity of 66,000 cfm at 90 F against a static pressure of 11.0 in. w.g. when running at 695 rpm; inlet damper control. — American Blower Co.

Drive—200 hp, 3 phase, 440 v, 720 rpm induction motors.—Westinghouse Electric Corp.

Cinder Collectors (2)

Multi-cyclone, tubular type, 152 tubes, 19 rows wide by 8 rows deep. — Western Precipitation Corp.

Turbine Generators (2)

20,000 kw, 80 per cent pf (25,000 kva), 3600 rpm, air cooled generators, 13,800 v, 3 phase, 60 cycle, with direct connected exciter and pilot exciter.

Horizontal condensing, one two-row impulse stage, 25 reaction stages, with three points of extraction feedwater heating. Design conditions are 650 psi gage 825 F at throttle, 1½ in. Hg abs pressure at exhaust hood.—Allis-Chalmers Mfg. Co.

Condensers (2)

Horizontal, two-pass surface condensers, divided waterbox, ⅛ in. No. 18 B.W.G. Admiralty mixture tubes, cooling surface 17,350 sq ft.

Duplicate sets of steam jet air ejector equipment.

Rated capacity of condenser, 180,000 lb per hr.—Allis-Chalmers Mfg. Co.

Circulating Pumps (2)

Vertical shaft, axial flow, propeller type with adjustable vanes controlled remotely. Each designed to deliver 20,000 gpm against a total dynamic operating head of 19.8 ft.—Ingersoll-Rand Co.

Drive—200 hp, 3 phase, 60 cycle, 440 v, 880 rpm, vertical deep well hollow shaft weatherproof, induction motors.—Westinghouse Electric Corp.

Condensate Pumps (4)

Horizontal hotwell pumps designed to handle 400 gpm against a total dynamic head of 230 ft.—Allis-Chalmers Mfg. Co.

Drive—50 hp, 3 phase, 60 cycle, 440 v, 1,200 rpm induction motors.—Allis-Chalmers Mfg. Co.

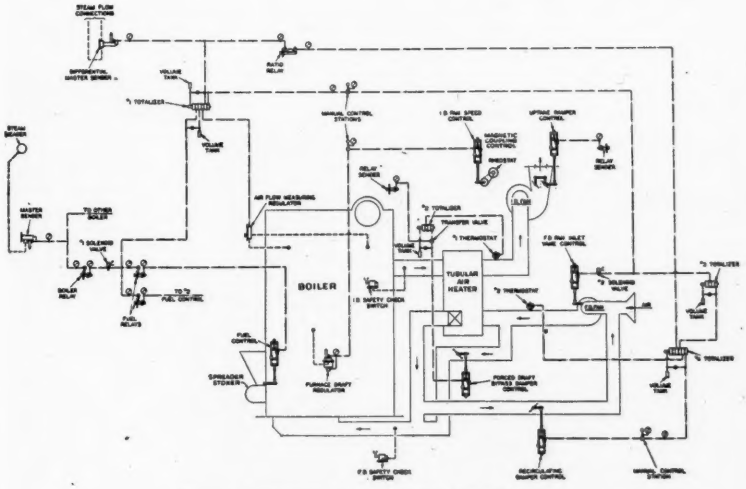


Fig. 10. Diagram of combustion control layout

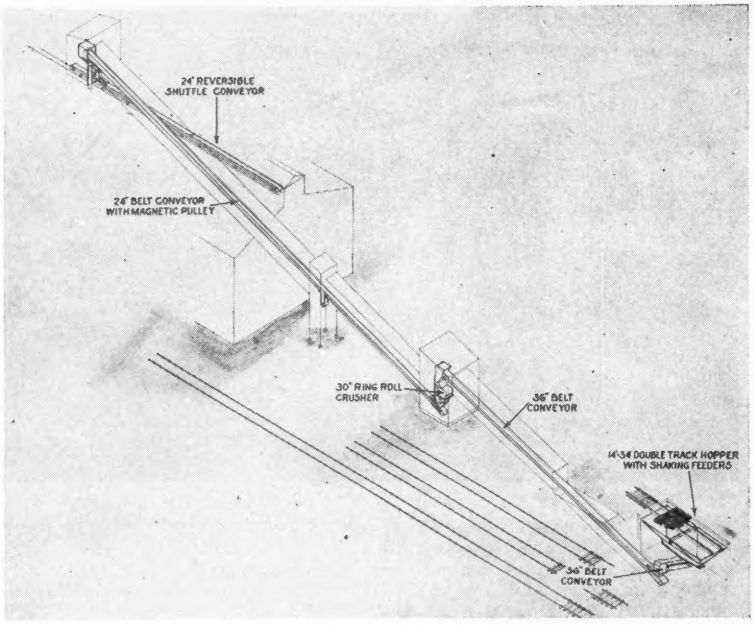

24" REVERSIBLE SHUTTLE CONVEYOR
24" BELT CONVEYOR WITH MAGNETIC PULLEY
30" RING ROLL CRUSHER
36" BELT CONVEYOR
14-34 DOUBLE TRACK HOPPER WITH SHAKING FEEDERS
36" BELT CONVEYOR

Fig. 12. Isometric showing arrangement of new coal handling system

Boiler Feed Pumps (3)

Horizontally split, 6-stage centrifugal pumps each designed to deliver 332,000 lb per hr of water at 283 F against a total dynamic head of 887 psi gage. Casings are 4 to 6 per cent chrome steel—Worthington Pump and Machinery Corp.

Drive—Two 500 hp, 3 phase, 60 cycle, 440 v, 3600 rpm induction motors.—General Electric Co.

One 530 hp quick-starting steam turbine, 650 psi, 825 F at throttle, exhausting to heater or atmosphere.—The Terry Steam Turbine Co.

First Point Heaters (2)

Vertical closed floating head type heaters, 706 sq ft tube surface, Admiralty B-111 tubes, working pressure on water side, 1100 psi gage and on steam side 250 psi gage.—Alco Products Division.

Second Point Heaters (2)

Vertical deaerating type heater with 5 minute water storage capacity, 332,100 lb per hr output, 0.005 cc oxygen guarantee, maximum working pressure 52 psi gage.—Cochrane Corp.

Third Point Heaters (2)

Vertical closed floating head type heaters, 918 sq ft tube surface, Admiralty B-111 tubes, working pressure on water side 125 psi gage and on steam side 50 psi gage.—Alco Products Division.

Coal Handling

Capacity, 125 tons per hr. Two section single track hopper, double element reciprocating pan feeder, 36 in. belt feeder, 36 in. inclined belt conveyor to crusher, hammermill type coal crusher, 24 in. inclined belt conveyor, and 24 in. horizontal shuttle conveyor.—Link-Belt Co., conveyors; Pennsylvania Crusher Co., crusher and Continental Electric Co., Inc., motors.

Ash Handling

Capacity, 20 tons per hr. Four stoker ash hoppers, four plenum chamber hoppers, four fly ash collecting bins and conveying piping. Pneumatic handling.—United Conveyor Corp.

Traveling Water Screens (2)

Front wash screens, 28 ft centers with 6 ft 4 in. wide baskets.—Chain Belt Co.

Service Water Pump (1)

Vertical shaft, two stage, turbine pump designed to deliver 2000 gpm against a total dynamic head of 176 ft.—Pomona Pump Co.

Drive—100 hp, 3 phase, 60 cycle, 440 v, 1800 rpm induction motor.—General Electric Co.

High Pressure Air Compressors (1)

Horizontal 11 x 5 x 11 air compressor with intercooler, aftercooler, intake silencer filter and V-belt drive. Actual air discharge of 253 cfm at 350 psi gage.—Pennsylvania Pump and Compressor Co.

Drive—75 hp, 3 phase, 60 cycle, 440 v, 1200 rpm induction motor.—U. S. Electrical Motors, Inc.

Oil Circuit Breakers (10)

Eight 1200 amp 15 kv outdoor type; two 2000 amp 15 kv, operating at 13.8 kv.—General Electric Co.

Disconnecting Switches (36)

Thirty-two 1200 amp outdoor 3-pole gang operated; four 2000 amp outdoor 3-pole gang operated; 15 kv insulated for 23 kv.—Delta-Star Electric Co.

Station Service Transformers (2)

2000 kva, 3 phase, OISC, 13,800/480 v transformers.—Allis-Chalmers Mfg. Co.

Control Switchboard

13.8 kv control complete with instruments, control switches and relays.—Westinghouse Electric Corp.

Station Service Switchgear — Westinghouse Electric Corp.
Gage Boards—G. and N. Engineering Co.
Bus Supports and Switchgear Insulators—Lapp Insulator Co., Inc.

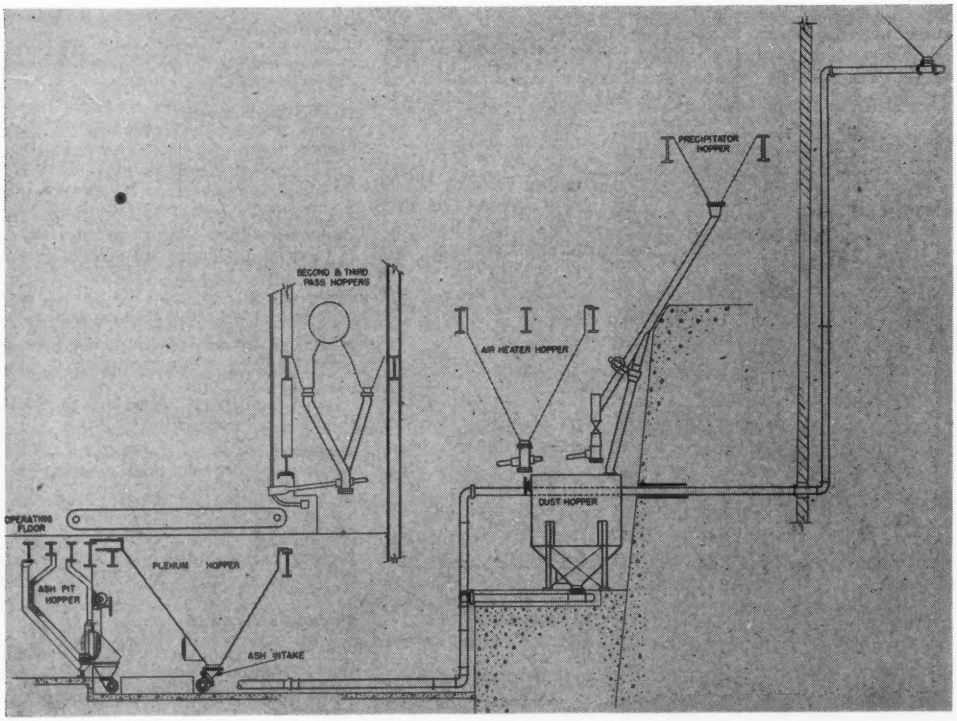


Fig. 13. Sectional view of ash disposal system. The cinder collectors have been elevated to secure gravity flow of the cinders either to the reinjection system or to ash collecting bins

Chicago Water Filtration Plant Designed to Pump 700 Million Gallons a Day

CHICAGO'S South District water filtration plant, claimed to be the world's largest rapid sand filtration plant, is nearing completion. Construction started in the fall of 1938, and in March of this year was 83 per cent completed according to planned expenditure. The plant will cost $24,500,000 and will be completed this year.

Located at 79th St. and Lake Michigan, the plant has a designed pumping capacity of 700 million gallons a day and serves an area of 115 square miles within the city as well as a considerable suburban area. The total population to be served is 1,350,000.

Part of the plant, including the low lift pumping station, was placed in operation in 1945, but the sand filters are being by-passed pending their completion, and chlorination is used to purify the water. The flow of water through the plant at present is from the lake to the intake basins, through the low lift pumps to the mixing and settling basins, to the settled-water header, by-passing the filters and filtered-water reservoirs to the outlet shaft.

Low-Lift Pumping Station

Designed for nine pumps with a capacity of 700 million gallons a day, the station at present has eight pumps installed with space and connections provided for a ninth 100 mgd pump. The horizontal, motor-driven centrifugal pumps are rated to pump against a 31.5 ft head. The four 100 mgd pumps and four 50 mgd pumps are spaced alternately, numbers 1, 3, 5, and 7 being 100 mgd and 2, 4, 6, and 8 being 50 mgd. At present six pumps carry the load with two ready for standby service.

Built by Allis-Chalmers, the 100 mgd pumps have an intake diameter of 54 in. and a discharge diameter of 38 in. The 50 mgd pumps have 42 in. intake and 36 in. discharge diameters. The motors, made by the Electric Machinery Mfg. Co., are all synchronous motors, operating at 100 per cent power factor on 2300 volt 60 cycle current. The motors for the 100 mgd pumps are rated at 700 hp at 240 rpm, and for the 50 mgd at 350 hp at 300 rpm. Both sizes are separately excited with 125 v direct current.

Flow Meters

Meters which measure the flow from each individual pump and indicate on dials in the pumping station are planned, but have not been installed as yet. The flow to each of the three concrete settling basins is determined by using concrete Venturi tubes leading into each basin. The total quantity flowing through the outlet shaft of the plant is measured with a Sparling meter.

This meter is of the remote recording type, utilizing a strip chart which furnishes a record of the total flow in millions of gallons per day for a sixty day period. The propellor is located in the 16 ft diameter outlet shaft which is some 40 ft below the water level of the lake, and the recorder is in the control room of the chemical building, approximately 1600 ft from the propellor. Another Sparling meter is used in the by-pass line from the Dunne Crib, with its recorder also in the control room.

Fig. 1. (Above) Close-up of one of the horizontal centrifugal pumps used in Chicago's South District filtration plant

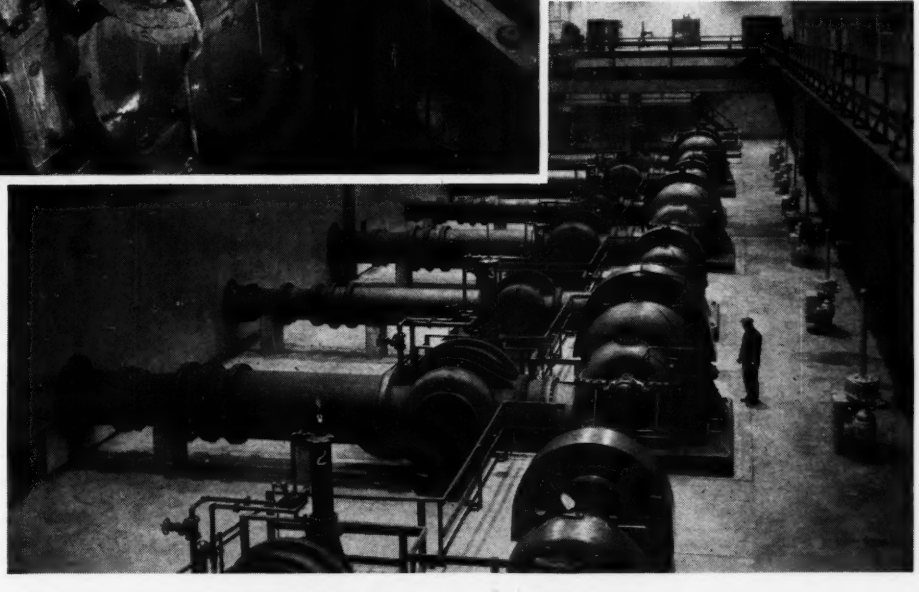


Fig. 2. (Right) The Low-Lift Pumping Station. Odd-numbered pumps are rated 100 mgd and even-numbered 50 mgd

Engineering Problems of Water Treatment . . . . .

Water treatment in a given power plant is mostly engineering with a modest amount of chemistry . . . The author shows how recurrent troubles in water treatment are not due to voids in the science of water chemistry, as often charged, but frequently to unwarranted economizing on first costs and inadequate instruction of personnel . . . Need for preliminary studies, adequate capacity, operating guides, equipment not "stuffed" into plant . . . Proper instruments and records . . . Selection and training of operators . . . Technical counsel . . . Operators' manual . . .

By Leo F. Collins

Chemical Engineer, The Detroit Edison Company

DEVELOPMENTS in the processing of water comprise one of the most useful contributions to steam boiler plant operation that have been evolved during the past 20 years. Even so, a complete technology has not yet been developed. Thus, in the higher ranges of boiler pressures, water conditioning, of necessity, partakes more and more of the nature of experimentation. Engineers conversant with overall aspects of plant operation recognize this limitation and, generally, are tolerant when troubles occur. But, when troubles occur at pressures for which the technology of water conditioning is virtually complete, they are usually quite emphatic in contending that such failures are manifestations of voids in the science of water chemistry.

The writer has spent more than 20 years in the second class of plants, diagnosing and correcting such troubles and in conducting research studies of a complementary nature. This experience has embraced a variety of industrial plants, and those serving large institutional building groups, as well as utility plants. In this capacity, he has observed that *recurrent troubles* are more often the result of misapplication of the art of treatment than of voids in the science of water chemistry.

From a paper entitled Some Engineering Considerations Related to Water Conditioning in Plants Using High Percentages of Chemically-Treated Makeup, presented April 3, 1946, before the Midwest Power Conference, Chicago, Ill.

Basic Causes of Recurrent Troubles

Unwarranted efforts to economize and inadequate instruction of those responsible for the actual operation of treating equipment have been observed as most frequently the basic causes for recurrent troubles.

What is involved can be better appreciated by considering the expedients usually employed in minimizing such costs. They are:

1. Preliminary studies are omitted or superficially conducted.
2. Inadequate treating capacity is provided.
3. Too few operating guides are supplied.
4. Treating equipment is "stuffed" into the plant.

1—Preliminary Studies

A competent method of treatment is one which consistently produces

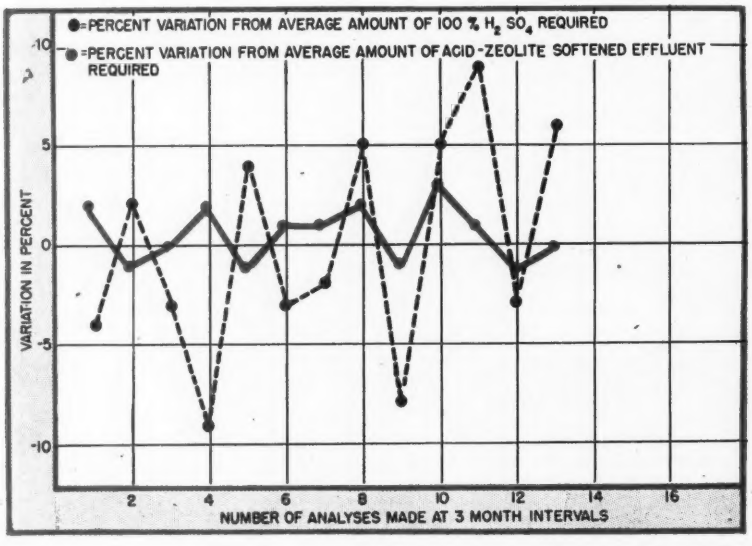


TABLE SHOWING ANALYSIS OF WELL WATER

(All values, except pH, are parts per million)

Silica—SiO	14
Oxides—Fe_2O_3 and Al_2O_3	6
Calcium—Ca	116
Magnesium—Mg	28
Sodium—Na	Trace
Bicorbonate—HCO_3	423
Carbonate—CO_3	0
Chloride—Cl	9
Sulphate—SO_4	45
Dissolved Oxygen—O_2	11
Free CO_2	16
pH Value	7.2
Total Hardness—as $CaCO_3$	405
Total Solids—(On Evaporation)	434

Fig. 1. Influence of changes in composition of a well water supply—see table—on the direct proportioning of acid, compared to use of acid zeolite, to produce an effluent of fixed low alkalinity

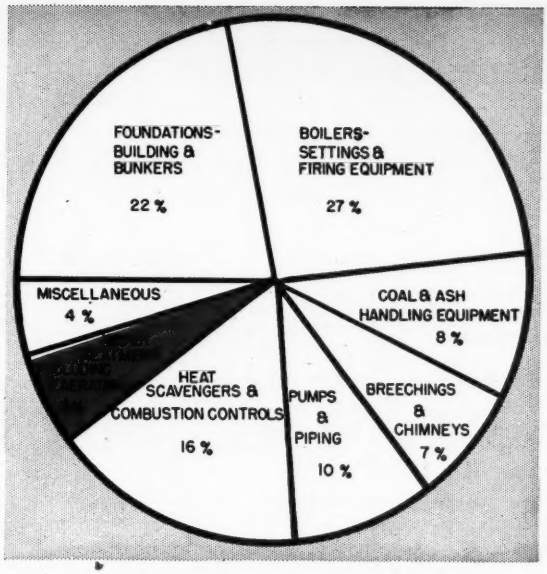


Fig. 2. Investment cost distribution for low-pressure power plants. This chart shows that "refinements" comprise about a quarter of total cost. Yet their use more than doubles available steam generating capacity
(H. Bleibtreu)

satisfactory results and requires a minimum of operating attention. Those systems that can be made to produce acceptable results, but in doing so demand frequent adjustments, are almost certain to develop troubles. It is a characteristic of such systems that they have been predicated more upon assumptions than upon the results of adequate preliminary studies.

The procedure most frequently followed in inaugurating treatment is to solicit proposals from vendors and, subsequently, to select what appears to be the "best scheme." Such procedure assumes that all vendors have made preliminary studies before submitting their proposals. While invariably all reputable vendors do make some studies, it should be noted that:

1. Vendors are primarily concerned with the marketing of their products. Thus, they may not reasonably be expected to make studies other than those required to attest the performance of their products.

2. Vendors have sound reasons for believing that price will be the deciding factor. Engineering surveys add to the price of products, and some competitors invariably use assumptions in lieu of engineering surveys.

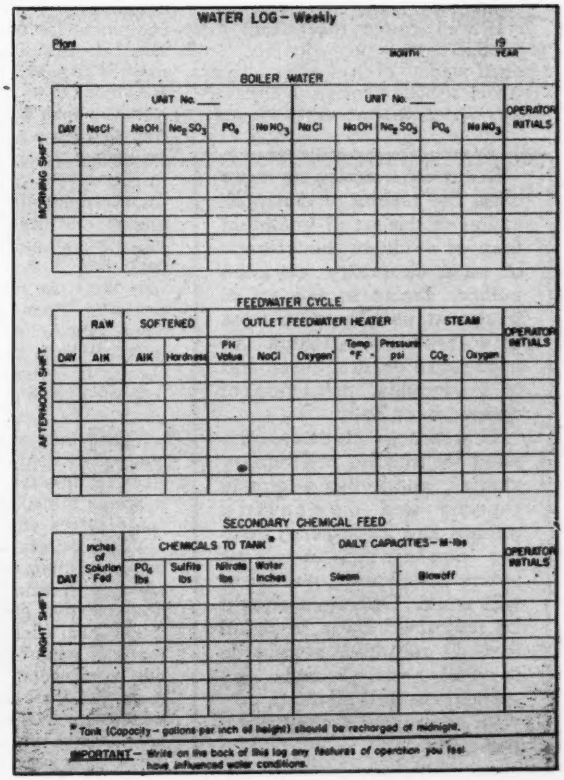
3. Unless a vendor is supplying the entire system, he cannot be expected to make studies covering the whole system.

In no way is the foregoing intended as a criticism of reputable vendors. It is recognized that they are well qualified to give sound advice predicated on broad experiences. But, no vendor can afford to engineer the whole system for the purpose of marketing only a part thereof, subject to competitive bidding.

To illustrate that a vendor, as well as a user, may suffer as a result of inadequate preliminary studies, the following case is cited:

Water from a sodium zeolite unit was used as part of the boiler input. The raw water was of such nature that after zeolite softening, prohibitive alkalinities persisted in the boilers and foaming resulted. Accordingly, it was concluded that if sulphuric acid were proportioned following the zeolite softeners, the troubles would abate.

Competitive bids were solicited for an acid proportioner to treat the water stipulated in the accompanying table. After the proportioner was installed, the plant operators found it impossible to accurately control the acid. As a result, the feed lines became corroded to the point of failure, and the proportioner was branded as a "flop."


WATER LOG – Weekly

Plant _____ MONTH _____ 19 YEAR

BOILER WATER

DAY	UNIT No. ___ NaCl	NaOH	Na_2SO_3	PO_4	$NaNO_3$	UNIT No. ___ NaCl	NaOH	Na_2SO_3	PO_4	$NaNO_3$	OPERATOR INITIALS
MORNING SHIFT											

FEEDWATER CYCLE

DAY	RAW Alk	SOFTENED Alk	SOFTENED Hardness	OUTLET FEEDWATER HEATER pH Value	NaCl	Oxygen	Temp °F	Pressure psi	STEAM CO_2	STEAM Oxygen	OPERATOR INITIALS
AFTERNOON SHIFT											

SECONDARY CHEMICAL FEED

DAY	Inches of Solution Fed	CHEMICALS TO TANK* PO_4 lbs	Sulfite lbs	Nitrate lbs	Water inches	DAILY CAPACITIES – M-lbs Steam	Blowoff	OPERATOR INITIALS
NIGHT SHIFT								

* Tank (Capacity – gallons per inch of height) should be recharged at midnight.

IMPORTANT – Write on the back of this log any features of operation you feel have influenced water conditions.

Fig. 3. Weekly record form for shift operators of water treatment equipment. As working periods rotate, operators are made familiar with all the jobs involved. This relieves monotony, eliminates shortcuts, aids cross-checking

Subsequently, an engineering survey was made. This revealed that the well water supply was of such variable composition that large variations in acid feed would be required to meet the prescribed conditions; that if an acid zeolite softener were used in lieu of acid proportioning, much more constant conditions would ensue. The per cent variations for both conditions are shown in Fig. 1. As a result, the acid zeolite was adopted and satisfactory performance was obtained.

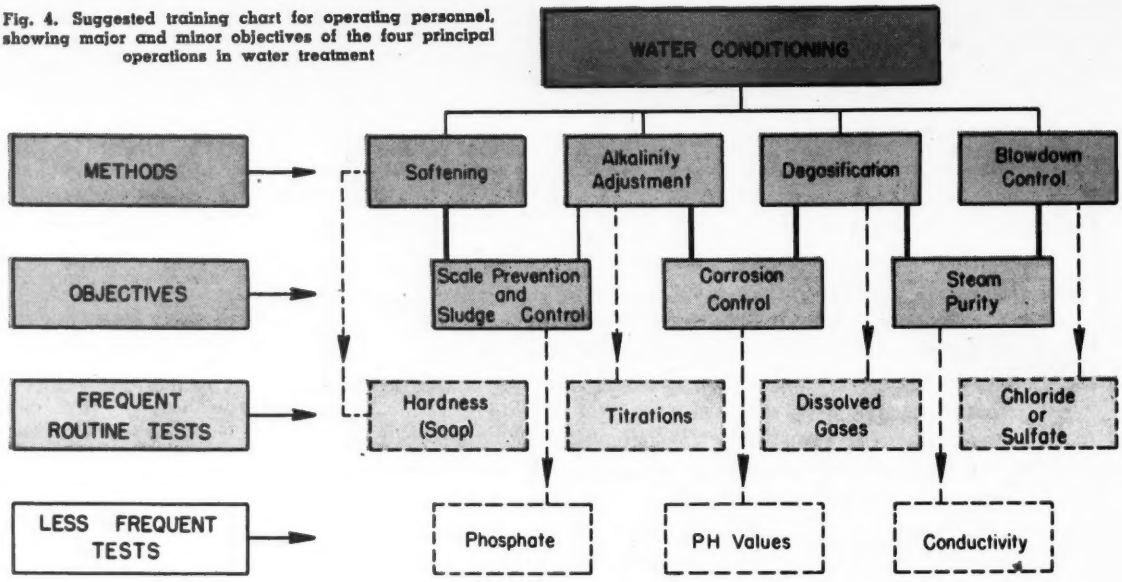
In view of such observations it seems reasonable to conclude that if any plant is to acquire an optimum method of treatment, preliminary studies are mandatory; that these should be made by a technologist, responsible for the development of *the entire treating system.*

2—Treating Capacity

In plants where the entire treating method consists merely in introducing chemicals into the feedwater or directly into the boiler, so little treating equipment is employed that virtually no considerations of treating capacity are involved. However, it should probably be pointed out that in some plants, the use of limited treatment requires that boilers be operated at lower steaming rates than is otherwise possible. Thus, indirectly at least, such treatments lack capacity.

Where more "elaborate" treating schemes are involved, one of two pol-

Fig. 4. Suggested training chart for operating personnel, showing major and minor objectives of the four principal operations in water treatment



icies is usually pursued: Occasionally, it is held that if one treating unit becomes inoperative, there should still remain adequate capacity to meet the maximum boiler demand. More often it is held that the treating system should be capable of operating under overload conditions to meet peak demands.

The former is generally regarded as ultra-conservative engineering and the latter as the more reasonable approach. A more critical analysis, however, does not always agree with the commonly accepted view.

It is well known that steam can be produced from inadequately conditioned water—even a scale former. To avoid serious damage, boilers are usually operated at low steaming rates and are cleaned internally at rather frequent intervals.

Recurrent troubles are more often the results of misapplication of the art of treatment than of voids in the science of water chemistry, says the author. Errors in the art of treatment usually stem from unwarranted attempts to economize on first costs, and to inadequate instruction of operators, or both.

This article stresses the need for making preliminary studies, supplying adequate capacity and operating guides, and for housing treating equipment in places where intelligent operators will work. Operators should be instructed more in detail than is required merely to conduct routine tests. All plants can well afford to provide competent technical supervision.

It is equally as well known that when the feedwater is precisely conditioned, the steam generating capacity of a given boiler is limited principally by the capacity of the fuel burning equipment.

To meet a given plant demand, therefore, one of two expedients may be employed: Either adequate "essential" equipment may be provided which, when operated at low steaming rates, will meet the plant demand, or a minimum of "essential" equipment, plus those refinements which facilitate high steaming rates, may be utilized.

It has been shown by Bleibtreu that the investment cost distribution for well-engineered plants (250 psi or lower) is substantially as shown in Fig. 2. From these data it is clear that "refinements," such as heat scavengers and water conditioning, embrace about one-quarter of the total cost. But, it should not be overlooked that their use more than doubles the *available* steam generating capacity. Thus, the *overall* investment per unit of capacity with these refinements is substantially less than where only essential equipment is used.

Where only a minimum of essential equipment is provided so as to utilize the benefits from such refinements, it seems difficult to agree that ultra-conservative engineering is involved.

When boilers are to be operated at peak steaming rates, the provision of standby treating capacity is advisable for two general reasons: First, under such conditions the boilers demand a water of optimum chemical quality. Second, when treating equipment is operated at overloads, the water invariably is less precisely conditioned than otherwise is true. Thus, in plants designed to operate at high steaming rates, standby treating capacity is essential and should never be regarded as excess capacity.

With hot-process softening, lack of adequate filters seems to be one of the more common limitations. With zeolite softening, inadequate storage of treated water seems to be a fairly common limitation.

A chemical proportioning pump that may be used in an emergency to supplement external treating equipment (and which is usually located in an obscure place) is regarded as a poor substitute for standby treating capacity. Invariably, when the emergency occurs, either the operators become confused, or the apparatus refuses to function until after the emergency has passed. In addition, there is always the chance of a mistake. A case is recalled where granulated soap was introduced into the emergency treating system. The results were such that the system has since been removed.

3—Operating Guides

Since the modern industrial steam boiler is one of the world's most critical users of water, chemical conditions must be maintained within rather narrow limits almost constantly or troubles are inevitable. Accordingly, all the processes used in conditioning the feedwater must be closely controlled. To this end, means for detecting changes *as they occur* are the acknowledged wants.

Instruments for Power Plant Water Tests

At present, meters that will measure chemical concentrations and that are otherwise suitable for installation in power plants are unavailable. Pending their developments, the following substitutes must be used.

1. Indicating and recording instruments that reveal physical changes.

2. Sampling and routine chemical testing apparatus.

3. A system for keeping records.

In the first named class are thermometers, pressure gages, and other comparable instruments designed to measure physical conditions. Insofar as water conditioning is concerned, the measurements of physical conditions are of value only when their relation to chemical conditions is known. For example, if the thermometer in the water space of a deaerating heater reveals a temperature substantially lower than the temperature of saturated steam at the pressure indicated by the gage on the steam space of the same heater, it is indicated that the unit is "gas-bound" and, therefore, that intolerable amounts of oxygen are inevitable in the effluent.

Conceivably, neither the pressure gauge nor the thermometer are essential insofar as the mechanics of operation are concerned. But, the example should suffice to show that the mechanics of operation are *not* necessarily the criteria that determine the instruments required for water processing. Thus, instruments of this type are sometimes required which, from a mechanical standpoint, appear superflous. They should be located at key points and a routine established whereby operators are required to *read and record* the results thus made available. Unless such a routine is established, it is almost a certainty that such instruments will eventually be overlooked.

Value of Routine Tests

There is no gainsaying the fact that routine chemical tests are a poor substitute for continuous records. But, since they are the only known means for gauging certain essential chemical concentrations, nothing is to be gained by griping about them or arbitrarily eliminating them. A more logical approach is to provide conditions that will expedite their performance. To this end, the following are helpful:

1. Sampling facilities that are approved and that preclude messing of the premises.

2. Chemical tests that are as simple as conditions will permit.

3. A clean, well-lighted cabinet in which the tests may be performed and in which the test apparatus may be housed.

4. Forms upon which the results must be recorded and to which operators may readily refer.

Samples piped (usually with copper tubing) to a central point provided with a slop sink is the acknowledged requirement for routine control tests, but rarely are such facilities provided. Without them it is inevitable that the premises will be "messy," and that the complaints that ensue will eventuate in samples being collected in a questionable manner. Poor samples and, as a result, faulty analytical results, are always misleading.

For most of the routine tests made on boiler waters, analytical techniques have been developed that are childishly simple. However, they are all predicated upon the proposition that the analytical tools will be kept clean, and that the test will be conducted in well lighted spaces.

In the author's opinion, a double-door stationary cabinet, (mounted on legs about 18 in. high), the internal surfaces of which are sprayed with flat white paint and lighted by a "dayelite" bulb or similar means, provides a suitable cabinet.

Records Are Important

Forms for recording test results and other relevant data must usually be developed to meet individual plant requirements. In well-operated plants, physical data, such as temperatures, pressures, etc., are usually recorded in the boiler room log. In such instances a form, such as that shown in Fig. 3, may be used to record water conditioning indices. This form was devised particularly for shift operators. As their working periods rotate, they are kept familiar with all the jobs that are entailed. This serves to break the monotony of routine work. It likewise mitigates against the "inventon" of short-cuts. It facilitates the cross-checking of results, and since its use-time is ony a week, it usually does not become so well-smeared as forms used for longer periods.

4—Housing of Treating Equipment

Fiction has it that many years ago a college freshman defined the essentials of a boiler room as: "Equipment, men, dirt, and a cat—the equipment to produce steam, the men to blot up the dirt, and the cat to keep the seat of the engineer's chair dusted."

Many boiler plants fit such a definition and they have been made even less inhabitable by stuffing water treating equipment into locations orginally intended to facilitate ease of operation. Such an arrangement dampens the enthusiasm of the plant personnel to operate and maintain not only the treating equipment, but adjacent equipment as well.

If, as is generally conceded, a competent method of treatment requres intelligent operators, then it would follow that the equipment must be located in a place where intelligent men will work. Younger operators seem to be well agreed that one of the characteristics of such space shall be that it can be kept clean with reasonable effort. Another characteristic is that the equipment shall be systematically arranged so as to facilitate ease of operation and maintenance. Whether or not such contentions are justified seems to be adequately answered by the fact that plants exhibiting such characteristics seldom experience recurrent troubles.

Instruction of Operators

Late in 1944, one of the large insurance companies was asked to provide, if possible, data which would disclose the nature and extent of troubles originated by water in industrial boilers. In reply it was indicated that "Statistical data of this nature are not available, but, offhand, it is our opinion that scale is at least a contributing factor in about 80 per

(Continued on page 120)

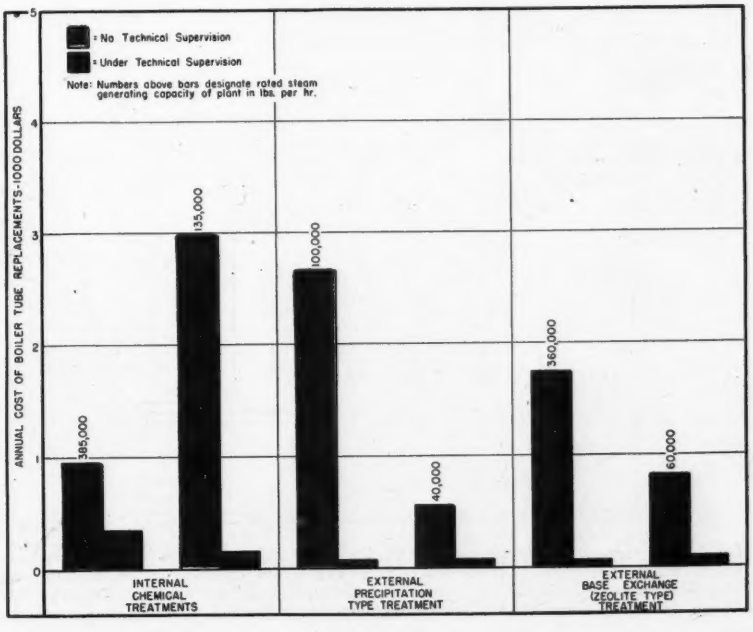


Fig. 5. Chart demonstrating the value of technical supervision of boiler water treating processes

Adjustable Speed MAGNETIC DRIVE

Electronically controlled adjustable speed magnetic drive provides an effective and stepless method of coupling constant speed alternating current motors to loads which have to operate at varying speeds. Such drives, as pointed out in this article, are well adapted to the driving of forced and induced draft fans and other auxiliaries in power stations

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AMONG the many problems involved in the design of modern steam-electric power plants the one concerned with the selection of proper methods of driving auxiliaries has given the designers much reason for study. The fact that the alternating current motor is essentially a constant speed device whereas many of the auxiliaries have to operate at widely varying speeds often make it impractical to couple the motor directly to the load; some sort of variable speed coupling device has to be placed between the motor and the load. Various types of variable speed coupling devices have been developed over the years among which is the magnetic type considered in this article.

The magnetic type of variable speed transmission lends itself well in driving power plant auxiliaries, especially in such applications with horsepower-torque relationships like those found with boiler forced draft fans. Since the operation of these adjustable speed magnetic drives are not generally understood by power plant operators it is the purpose of this article to describe this type of drive and discuss its operating features.

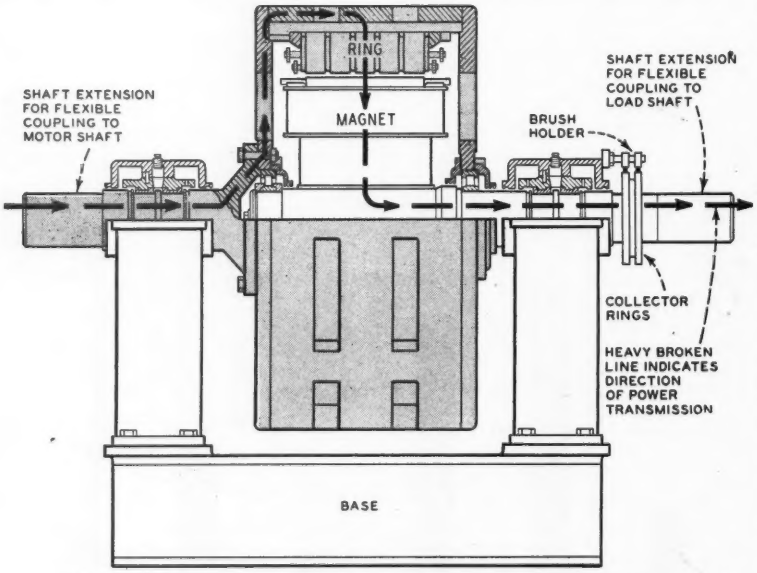


Fig. 1. Diagrammatic cross-section of Form MD-2 E-M Magnetic Drive showing constructional elements. Pedestal bearings are oil-lubricated sleeve type, supporting the Ring and Magnet members, which are maintained in accurate axial alignment by internal roller bearings

Fig. 2. Ring of Form MD-2 Magnetic Drive is "cage-torque" type, consisting of ring with laminated core and a specially-designed cage winding, similar to that of an induction motor

Construction

The adjustable speed magnetic drive system consists essentially of a constant speed motor driving a ring. Rotating within the ring is a magnet, coupled to the fan shaft or other load. The unit is compact and self-contained for mounting between motor and load. The operating speed of the magnet is controlled by adjusting the direct-current excitation to the magnet poles by means of an automatic electronic controller which uses a simple potentiometer pickup from the primary sensing device. Figure 1 shows one form of drive using the "cage-current" ring applied to the larger horsepower sizes. Figure 2 is a photograph showing the construction of the cage-current ring. Figures 3 and 4 are of the "eddy-current" form of construction for smaller capacities. Figure 5 shows the magnet construction.

The combination is readily recognized as an adaptation of a squirrel

cage motor in which both the "rotor" and "frame" are allowed to rotate, but at variable relative speeds. Cage bars in the ring are similar to squirrel-cage motor construction, and the rotation of the magnet energized from the control produces a revolving magnetic field such as the primary field developed in a squirrel cage induction motor. In the eddy-current form the principle of operation is the same but currents in the magnet do not have the directed low-resistance circulation provided by squirrel cage bars in the cage-current type. The difference is a matter of capacity, and so we usually find the eddy-current construction used in the smaller ratings.

The only wearing parts of the drive are the bearings and collector rings—there is no mechanical torque connection between ring and magnet. Operation is purely electro-magnetic and the control is achieved electrically by varying direct current through the magnet to transmit torque through the air-gap.

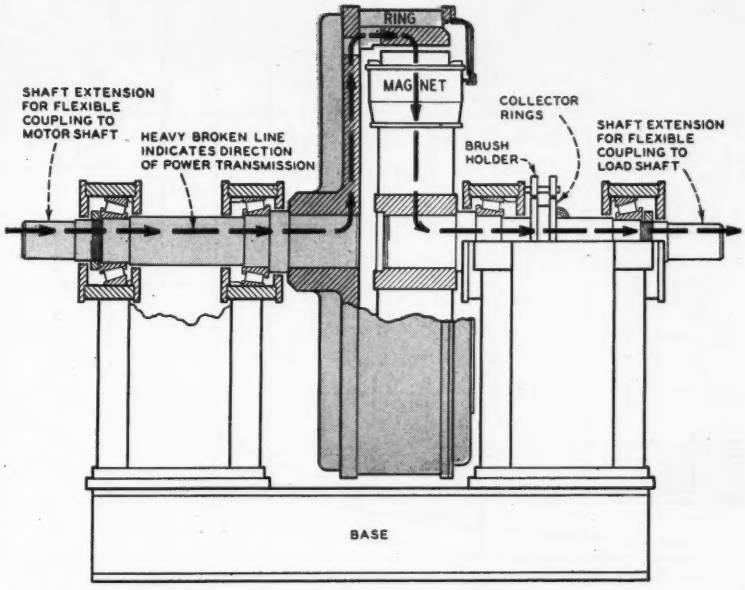


Fig. 3. Diagrammatic cross-section of Form MD-1 E-M Magnetic Drive showing constructional elements. Each pedestal contains two ball (or roller) bearings, supporting the overhung Ring and Magnet and maintaining them in accurate axial alignment

Operation

The ring of the magnetic drive revolves at the same speed as the driving motor. The magnet, separated by an air-gap from the ring, is free to revolve within the ring. The poles of the magnet are excited by direct current through collector rings on the magnet shaft. The magnet is of salient-pole construction so connected as to produce alternate north and south poles.

A difference in speed between the ring and the magnet results in a cutting, by the ring, of the magnetic flux produced by the magnet. This induces current in the ring, forming a magnetic field in the air gap. The magnetic field pulls on the poles of the magnet, thereby causing the magnet to revolve. Torque transmission takes place through the air-gap between ring and magnet. The amount of torque is varied precisely and over a wide range by varying the excitation of the magnet, thus controlling its speed. The speed of the magnet is dependent at any time on two factors: (1) the amount of control current, which determines the torque transmitted between motor and the load, and (2) on the torque required by the load. Since the amount of control current is instantly controllable electronically, the load speed can be kept constant regardless of change.

The difference in speed between ring and magnet can be considered in terms of slip. When the magnet is stationary and the ring is at full motor speed, the slip between ring and magnet is 100 per cent. As the speed of the magnet increases, the

Fig. 4. Ring of Form MD-1 Magnetic Drive is "eddy-torque" type, consisting of a specially-built annealed steel ring with radiating fins

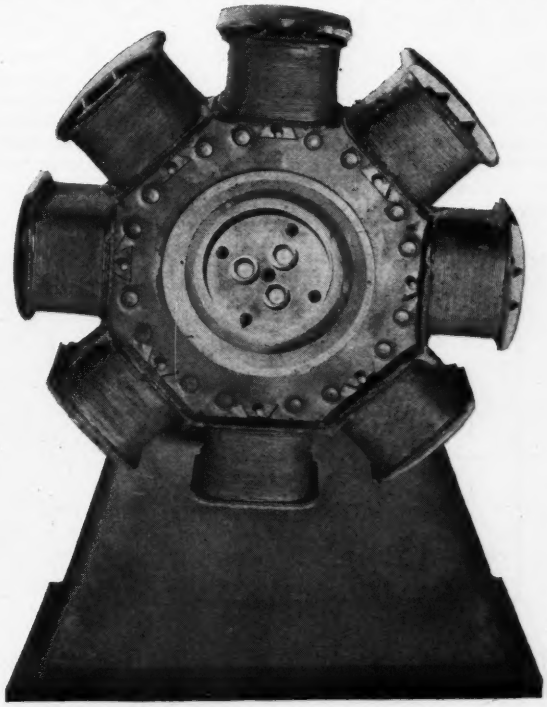


Fig. 5. Magnet is salient-pole construction, simple and durable. Winding has Class B insulation giving high margin of protection

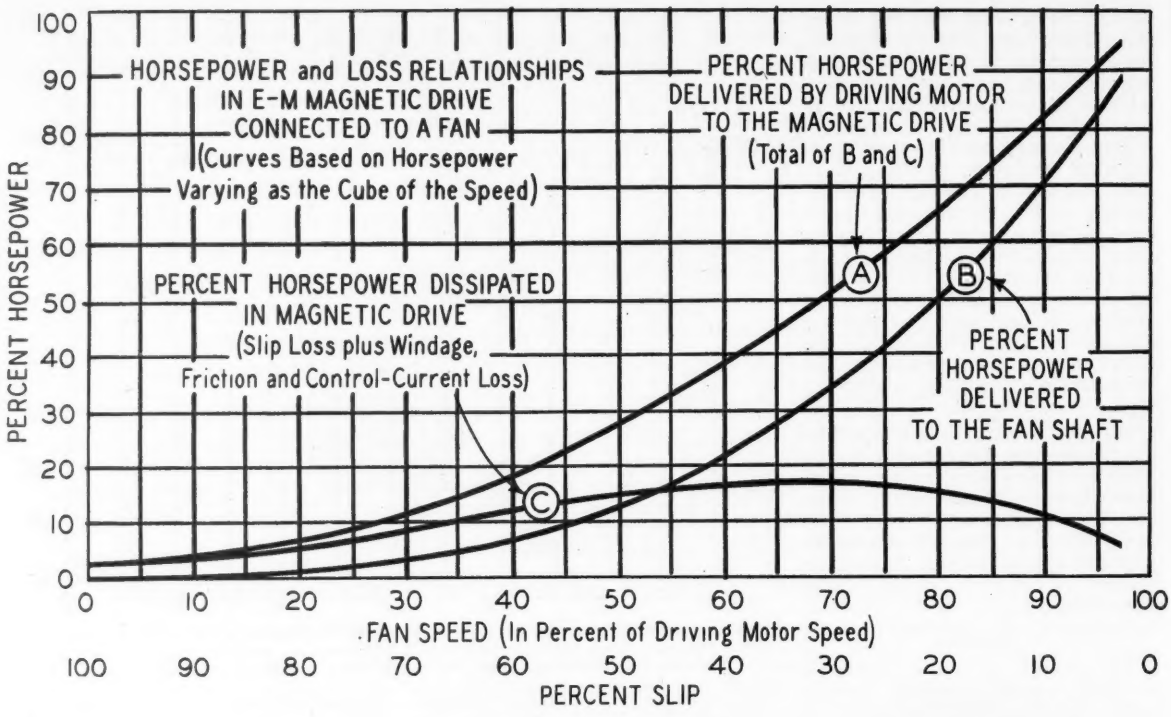


Fig. 6. Horsepower dissipated in the Magnetic Drive in reducing speed of the fan is shown by the typical "whale-back" curve C. Horsepower from curve C, added to actual power required to drive the fan at any given speed on curve B, gives the total horsepower input to the driving motor, curve A

slip decreases proportionally to the speed. When full rated excitation is applied to the magnet, and it is carrying full rated load, the slip is 3 per cent, which is the standard rated, full load minimum slip; thus, the maximum load speed is 97 per cent of the speed of the motor. It is apparent that the treatment of the magnetic drive as a "slip" device is exactly the same as that for a polyphase squirrel cage induction motor.

The magnetic drive is purely a torque transmitter; its torque output is always approximately equal to the torque input at any speed. It is not a troque converter (multiplier).

Characteristics

SPEED RESPONSE. A change in excitation to the magnet drive causes a practically instantaneous change in the torque transmitted. The rate of change of speed of the load, however, depends not only on the change of torque, but on the WK^2 of the load as well. The available maximum torque for acceleration will generally be not less than full load torque at the usual range of load operation.

LOSSES. The losses consist of slip loss, which appears as heat loss in the ring; excitation loss in the Magnet; windage and friction loss. The slip loss is the principal loss, the latter two being quite small. The slip loss varies directly with the difference in speed of rotation between ring and magnet, or between motor and load. Thus, at 3 per cent minimum slip, 3 per cent of the output of the motor will be dissipated as slip loss in the ring.

In the most important application, that of boiler draft fans, the power requirement drops off rapidly at reduced speed. With the fan shaft operating at 50 per cent of the motor speed, 50 per cent of the output of the motor *at that fan speed* will be slip loss in the ring. At such reduced speed, the energy dissipated in the

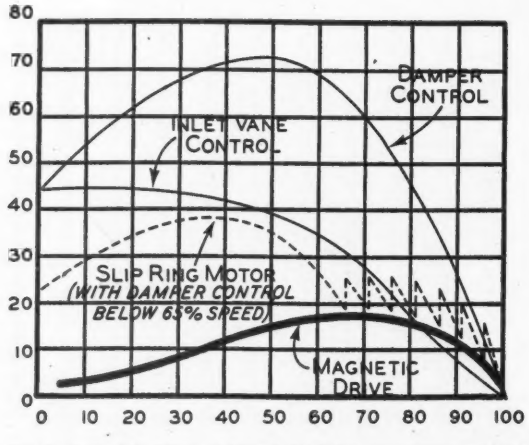


Fig. 7. Magnetic Drive on forced draft fan saves power as shown by approximate loss comparisons above for damper, vane and slip-ring induction motor methods

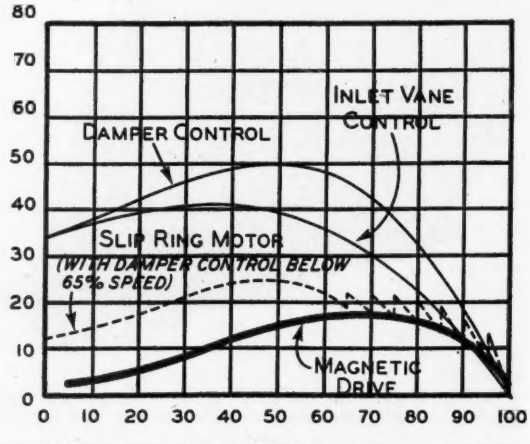


Fig. 8. Magnetic Drive on induced draft fan saves power as shown by approximate loss comparisons above for damper, vane and slip-ring induction motor methods

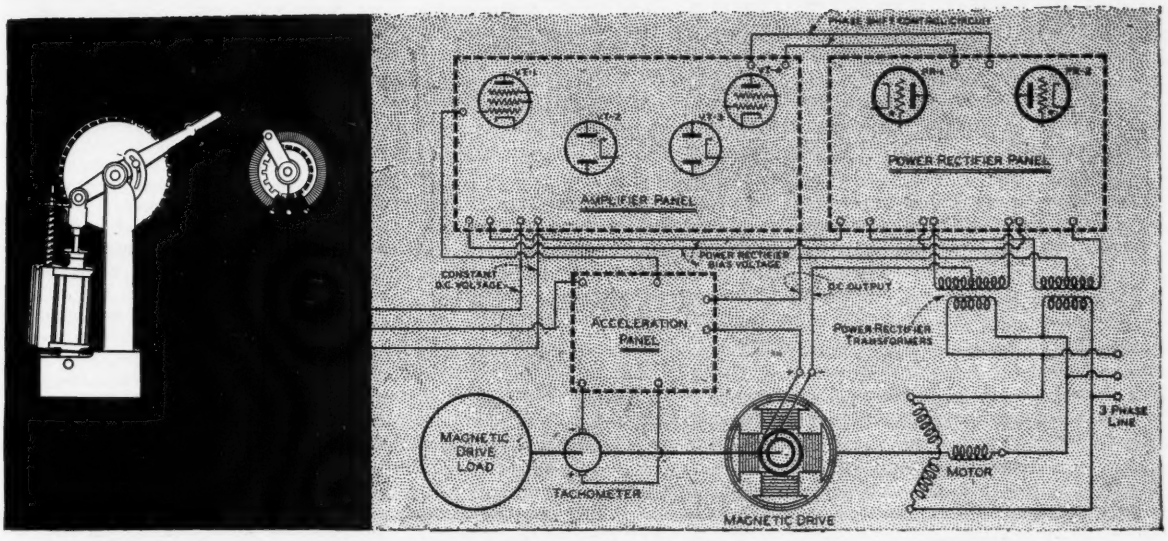


Fig. 9. Diagrammatic representations of one type of E-M "Regutron" electronic controller for Magnetic Drive showing operation in conjunction with automatic combustion control. A small potentiometer positioned by the combustion control, and balanced electrically against a speed-control tachometer, operates through an amplifier circuit to regulate the output of the power rectifier tubes and hence maintain required excitation for the Magnetic Drive

magnetic drive is not unduly large because the power required by the fan decreases approximately as the cube of its speed. Motor power output is consequently reduced to a comparatively small value. The magnetic drive slip loss at its maximum is only 15 per cent of the full load rating of the magnetic drive when operating a fan or load of similar characteristics.

Figure 6 shows the horsepower and loss relationship in a magnetic drive connected to a fan. For comparison of horsepower input and losses with other methods of fan output control, see Figs. 7 and 8.

The slip loss characteristic of the magnet drive is inherent in all torque transmitters operating on a slip principle. It occurs with a slip ring induction motor when the speed is reduced by inserting resistance in the rotor circuit, and the loss is dissipated in a bank of resistors separate from the motor. Loss proportionate to slip is also characteristic of fluid drives, frequently necessitating external cooling banks.

COOLING. No external cooling devices are used with the magnetic drive. The ring revolves always at motor speed, which makes it practical to self-cool the ring effectively. The magnet may operate at low speed, but the somewhat less effective self-ventilation is fully compensated for by the low excitation current that is then required. Inherently the operation and construction of the magnetic drive are favorable for effective heat dissipation.

STABILITY. By adjusting the value of control current, any desired per cent of torque transmission, and consequently of load speed, may be obtained. In the electronic control used, the control current is referred to the load speed; the control maintains constant speed regardless of load. Properly-timed response of the electronic control as compared with time characteristics of the drive and load, as well as control circuit design to eliminate electrical "slack", prohibits hunting or erratic operation of the magnetic drive. The use of rugged pickup equipment form the primary sensing device and moderate amounts of control power without trick circuits eliminates "phantom" malfunctions which may occur in high-amplification electronic circuits when control current leakage results from the entrance of small amounts of moisture into the wiring.

Control

Control of excitation to the magnet and thus of the speed is accomplished electronically. A three phase, 220 or 440-v supply is rectified and controlled to maintain the adjustable speed requirements. The circuit is shown in Fig. 9.

Output of a small tachometer generator driven from the magnet shaft actuates the control to hold operating speed of the load accurately as selected. Speed is selected by positioning the arm of a small potentiometer which is actuated by some type of automatic control such as the usual form of automatic combustion control.

The speed level is adjusted by the automatic control, and since changes in speed are referred to a tachometer, the selected speed is maintained under conditions of variation in prime mover speed or changes in load or voltage.

Vacuum tubes used in the control are standard types loaded at a conservative fraction of normal rating, with a normal life expectancy of 10,000 to 20,000 hours. The amplifier tubes are high vacuum types, and the power tubes furnishing magnet ex-

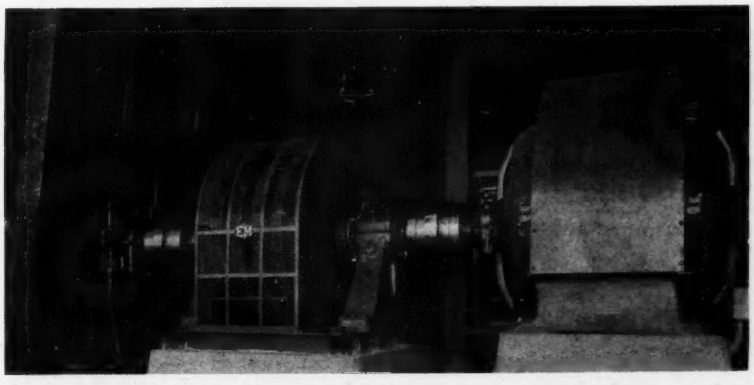


Fig. 10. This 752 hp, 1164/180 rpm Magnetic Drive operated by a synchronous motor is one of three units on induced draft fans at a large southern power company. Three 376 hp, 1150/180 rpm E-M Synchronous Motor-Magnetic Drive units are also used on the forced draft fans

citation are gas-filled. They can be replaced while the control is in use.

Stability in the control circuit is achieved by providing the control circuits with current and voltage-stabilizing transformers which are sensitive to rate of change of excitation current to the magnet and tachometer pickup voltage. The values obtained from these transformers are used to oppose rapid control current changes, thereby reducing magnetic drive acceleration and preventing load speed "overshoot", and hunting. Their effects are absent under steady-state conditions since one carries direct current from the tachometer and the other carries direct current from the magnet; there is no transformer action under steady-state operation of the magnetic drive.

The only rapidly moving part of the control is the tachometer belted to the magnet shaft.

Advantages

The magnetic drive provides a wide continuous speed range with entirely stable automatic control throughout. There are no steps in control requiring auxiliary damper control equipment synchronized with changes in fan speed. Thus there can be no disturbances while changing from one speed of operation to another. The same characteristics apply from maximum speed down to 10 per cent speed.

The speed response is quick, providing a good torque characteristic without sudden shock to the fan system. Whether the magnetic drive is to be energized before or after the driving motor is at full speed, the magnetic drive provides a torsionally flexible coupling for smooth acceleration.

Construction is simple and reliable, based on the years of development devoted to squirrel cage motor construction. The ring is inherently resistant to deterioration from heat. The magnet has an insulated winding, but it operates at relatively low temperature on a low excitation voltage. There is no oil to leak from the magnetic drive, and no separate cooling coils are required.

Whatever the type of motor drive used, saving in power result. This is most advantageous in those loads in which the horsepower requirement drops as the cube of speed. The magnetic drive method takes advantage of this characteristic in minimized power losses for a given fan output. Boiler draft fans are the outstanding application in which such savings may be effected, compared to other methods, as shown by Figs. 7 and 8.

Where liberal factor of safety is provided in selection of the fan, adjustable speed control operates to particular advantage. With damper or vane control, the most efficient range of operation is lost in dampering down to normal operation outputs. Adjustable speed control with the magnetic drive eliminates the need for heavy dampering and thus minimized the penalty in operating efficiency due to selection of oversize fans.

Longer fan life is insured. Fan erosion is estimated to vary between the cube and fifth power of fan speed. Thus the life of fans handling gases containing abrasive air can be increased substantially by operating at minimum speed.

Operation is quieter and smoother. Using the magnetic drive, the fan turns over at just the right speed to satisfy the draft requirements. Hence the boiler house is released from the roar of fans continually racing at top speed.

Application Considerations

Inherent features of the drive are advantageous in any application characterized by load torque which drops off rapidly with speed reduction; fans, centrifugal pumps, centrifugal refrigeration compressors, and centrifugal blowers fall in this classification. Magnetic drives are used for cement kiln fans, iron ore sintering fans, wind tunnels, propeller test stands, and other applications where the flow of air must be regulated, or known. The largest field is boiler draft fan, forced or induced. For such use, the magnetic drive has low losses through the range of operating speeds, and is a low-fixed-cost item.

Silicone Greases for Bearing Lubrication at HIGH or LOW Temperatures

Lubricants being developed from silicone products extend safe operating temperature range of bearings . . . Lubricants developed for ball bearings . . . Certain greases applicable for temperature range from —95 F to 300 F, others designed for temperatures from —4 F to 482 F . . . Table of specification given

PROGRESSIVE development of various silicone products has substantially increased permissible operating temperatures in a wide variety of industrial processes and equipment. The development of Silicone insulation, for example, has increased the permissible operating temperature of electrical equipment to 175 C (347 F) and above. Motors operating at such elevated temperatures require bearing lubricants having greater heat stability than the conventional petroleum greases possess. At the same time, high altitude flying and arctic operations have necessitated the development of lubricants serviceable at very low temperatures.

To supply the need for high and low temperature lubrication, Dow Corning Corp. has developed four silicone greases which are now available and has conducted experimental work from which the results given here have been summarized. These new silicone greases designed for the lubrication of ball bearings operating at abnormally high and low temperatures are characterized by a high order of heat stability, low volatility, relatively slight changes in consistency over a wide temperature range, and low freezing points.

Two of these greases, DC 31 and DC 41, are compounded of almost entirely inorganic materials. They are black in color due to the use of very finely divided carbon black as a thickening agent. They contain no graphite. Although they possess exceptional thermal stability, they do show a slight tendency to bleed during storage. Tests indicate, however, that this superficial bleeding does not impair the performance of these greases. DC 31 and DC 41 are corona resistant and are semi-conducting because of their carbon black content.

The other two greases, DC 33 and DC 44 are light brown in color. They are compounded with metallic soaps selected for their heat stability. DC 33 and DC 44 are serviceable at temperatures as high as the melting points of the metallic soaps. They show very little tendency to bleed. These two soap type silicone greases have just recently become available and a considerable amount of developmental work is still being done on them.

An indication of the low volatility

of the Silicone greases is contained in the following table.

Percentage of Weight Lost by Silicone Greases After 40 Hr at 175C (347F)

DC 31	DC 33	DC 41	DC 44
5.2%	4.6%	4.2%	3.3%

After 40 hours exposure at 175 C the silicone greases were still soft and serviceable.

Of these four silicone greases, DC 31 and DC 33 are designed primarily for low temperature lubrication, but they also operate efficiently at elevated temperatures. DC 41 and DC 44 are designed for high temperature lubrication.

It is recommended that old organic grease be removed and bearings cleaned before relubricating with the more heat stable silicone greases. If bearings are not accessible, however, the silicone greases can be added without damage since there is a limited compatibility between them and most petroleum greases.

A high order of temperature stability, resistance to water and general inertness suggest the use of silicone greases for permanently lubricated bearings, for lubricating ball bearings operating at high and low temperatures, for the lubrication of oven machinery, pumps handling hot salts, and for low speed equipment operating at temperatures up to 480-500 F.

Even though these greases are perfectly stable at elevated temperatures, there is still the problem of bearing design and construction to be considered. In some instances it will be found advisable to use bearings with larger clearances to compensate for temperature differential in the bearings. Preliminary tests have shown that the use of bronze ball cages materially lengthens the life of bearing sat elevated temperatures. The development of silicone greases for journal bearings and extreme pressure lubrication is still in the laboratory stage.

It may be observed in general that there are very few established test procedures for determining the relative serviceability of various greases. Many of the standard tests are in themselves inconclusive and the final proof of the quality of any grease is its performance under specific conditions. The Dow Corning Silicone greases have been tested under actual service condition. Their performance justifies the recommendation that in ball bearings causing repeated difficulty or requiring excessively frequent lubrication that silicone grease designed for such service be tried. Test samples will be sent upon receipt of a statement of the lubrication problem involved.

The characteristics of these greases recommend their use for:

1. **Permanently lubricated bearings.**
2. **Lubricating ball bearings operating at high and low temperatures.**
3. **For lubrication of oven machinery, pumps handling hot salts.**
4. **For lubricating low speed equipment operating at temperatures up to 480-500 F.**

SPECIFICATIONS FOR DOW-CORNING SILICONE GREASES

	Low Temperature Greases		High Temperature Greases	
	DC 31	DC 33	DC 41	DC 44
WORKED PENETROMETER (ASTM-D 217-44T)	300-310	280-330	295-305	200-250
FLASH POINT (ASTM-D 92-33)	505° F	528° F	537° F	550° F
DROPPING POINT (ASTM-D 566-42)	302° F	392° F	392° F	392° F
Not less than	150° C	200° C	200° C	200° C
BLEEDING (ANG-34 Specification) 16 hr at 100C—less than	6%	2%	4%	2%
TEMPERATURE RANGE at less than 4000 rpm				
Centigrade	—70 to 150°		—20 to 250°*	
Fahrenheit	—94 to 300°		—4 to 482°*	
TEMPERATURE RANGE up to 10,000 rpm				
Centigrade		—70 to 150°		—20 to 175°
Fahrenheit		—94 to 300°		—4 to 347°

*Efficient operation of bearings at temperatures above 175C (347F) may require frequent relubrication.

Low Temperature Ball Bearing Lubricants

DC 31 is an almost completely inorganic grease designed for low temperature lubrication at operating speeds of less than 4,000 rpm. It is serviceable at temperatures as low as —95 F and yet has about the same lubricating life as the best grades of high temperature petroleum grease at temperatures of 200 to 300 F. Prolonged operation at elevated temperatures does not appreciably affect the low temperature starting torque of DC 31.

Even at temperatures up to 480 F this grease does not melt, but it is not recommended for use at temperatures above 300 F. Tested in the No. 308 bearings of a 7½ hp motor operating under belt load at 1750 rpm, this grease had a service life of 460 hr at 284 F.

DC 31 is completely water-resistant under any service conditions. It is resistant to the oxidation of air or ozone. Additional specifications are given in the accompanying table.

DC 33, a silicone grease thickened with metallic soaps, was designed for low temperature lubrication of bearings operating at speeds up to 10,000 rpm. It is serviceable over a temperature range of —95 F to 300 F. The testing of this grease in a No. 212 ball bearing operating under no load at 1725 rpm was still in progress at the time of this writing after 1300 hr at 150 C (302 F) with no apparent deterioration in serviceability. The water resistance of DC 33 is comparable to that of calcium or lithium based petroleum greases. Other specifications are given in the table.

High Temperature Ball Bearing Lubricants

Dow Corning silicone grease No. 41 was designed for the lubrication of bearings operating at elevated temperatures and at speeds of less than 4000 rpm. Because it is an almost completely inorganic grease, DC 41 does not melt at temperatures in excess of 480 F, but more frequent lubrication is required because of increased bleeding at temperatures above 300 F. Its extreme heat resistance recommends it for special applications such as the lubrication of pumps handling molten salts and oven machinery of all kinds.

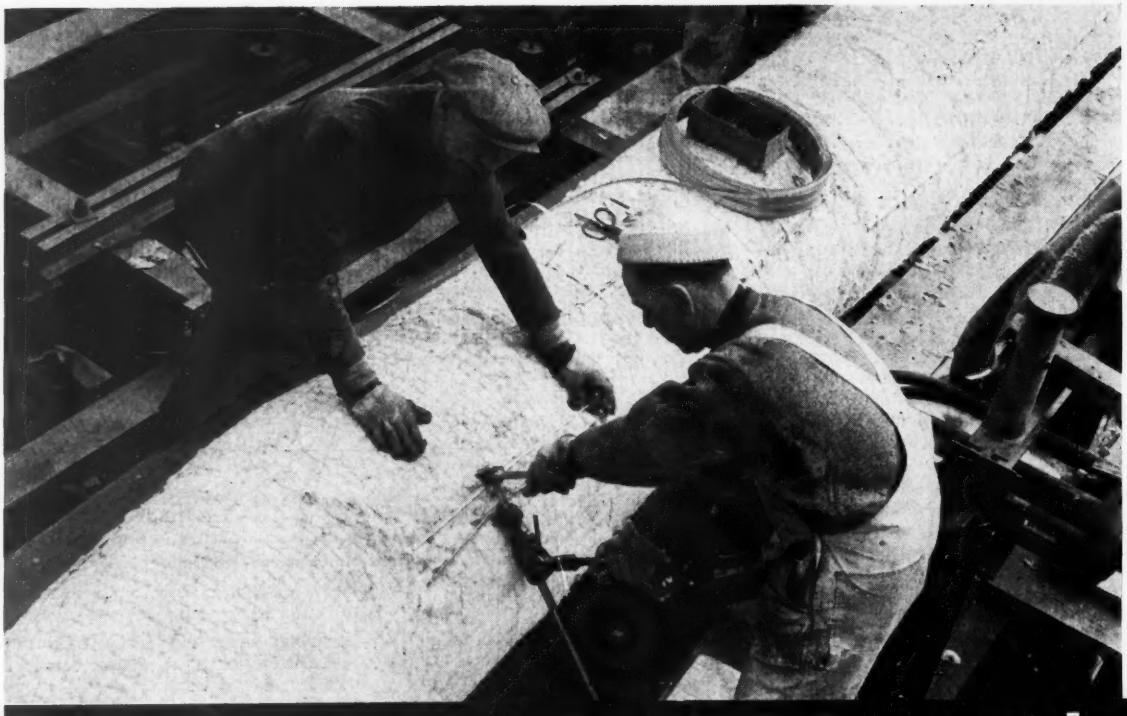
DC 41 is serviceable at temperatures as low as —4 F, and in the temperature range of 200 to 300 F, it has a long and efficient lubricating life. Tested in No. 212 bearings operating under a load of 150 lb at a speed of 1750 rpm, this grease was still serviceable after 2600 hr of operation at 257 F. In the same testing equipment, DC 41 had a service life of 900 hr at 347 F.

DC 41 is completely waterproof under any service conditions. It is resistant to the oxidation of air or ozone. Additional specifications are given in the table.

Silicone lubricant, DC 44, thickened with metallic soaps is designed for the high temperature lubrication of bearings operating at speeds up to 10,000 rpm. It is serviceable at temperatures as low as —4 F.

DC 44 is being tested in a number of different bearings operating at various speeds and temperatures. In a No. 204 bearing at a speed of 10,000 rpm, DC 44 is still serviceable after 700 hr at 302 F. It is still serviceable after 1300 hr in a No. 212 bearing operating under no load at 302 F and 1725 rpm.

The water resistance of DC 44 is comparable to that of calcium of lithium based petroleum greases. Other specifications are given in the table.



FIBROUS GLASS in the P

THE BASIC FORM of fibrous glass thermal insulation is a white, resilient blanket, of predetermined thickness, consisting of a mass of intricately interlaced glass fibers. This basic, wool-like form can be fabricated into batts, rolls, bulk fibers, and shredded fibers. It can be faced with paper, a fabric or a metal mesh. It can be compressed, treated with a small percentage of thermo-setting resin, and fabricated into preformed materials such as sheets or boards, blocks and molded pipe coverings.

The boards can be given a variety of surface treatments, including a sanded, smooth finish on one side, a paper or fabric facing on one side, and an over-all asphalt coating. Predetermined density of the boards ranges from 2.5 lb to 9 lb per cu ft. Density of the basic, wool-like form of this thermal insulation can be varied by compression over a similar range.

The K factor[1], at 50 deg mean temperature difference, ranges from 0.28 for the wool-like uncompressed forms at a normal density of 1.5 lb per cu ft, to 0.23 for a 9-lb density board. The low thermal conductivity is due primarily to the millions of air spaces entrapped by the interlaced fibers. These air spaces are poor conductors of heat. In addition, where the fibers cross and touch each other they have exceedingly small contact points. Heat, therefore, cannot pass readily from one fiber to another.

While low thermal conductivity is the factor of primary importance to the power plant engineer, there are many other factors that must be taken

[1]See notes at end of article.

Fig. 2. Applying Fiberglas molded pipe insulation

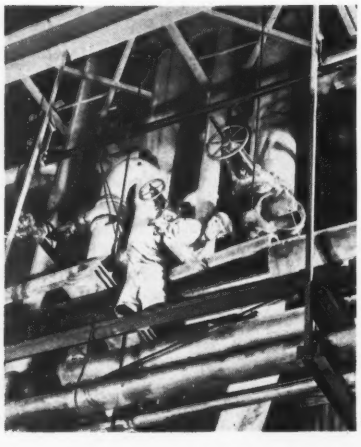


Fig. 3. Fiberglas being applied as duct insulation

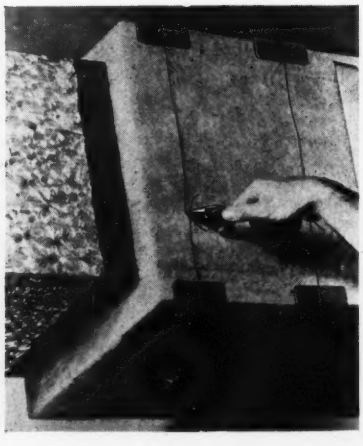


Fig. 4. Insulating high-pressure underground steam lines with Fiberglas

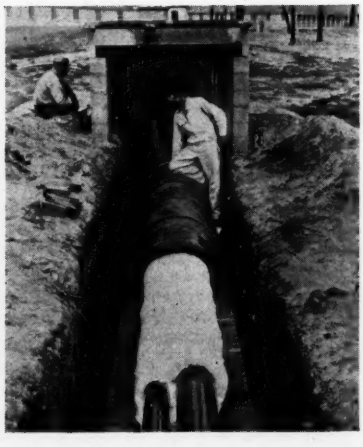


Fig. 1 (left). Workmen applying Fiberglas blanket type insulation to large pipe

into consideration in evaluating a thermal insulating material. These factors include fire-safety, resistance to rot, or to settlement under vibration, moisture pick-up, ease of handling and installation.

Inherently Fire-Safe and Rot-Proof

Fibrous glass thermal insulating materials are inherently fire-safe. The small amount of lubricant with which the fibers are treated, or the small amount of thermosetting resin used to give permanence of dimension, may volatilize at elevated temperatures. The fibers themselves are completely incombustible, and present a barrier to the spread of flame.

Immunity to rot and decay is an important property of these insulating materials. They provide no sustenance for insects or vermin of any kind. Properly installed, they do not settle down under shock or vibration, leaving gaps for heat to pass through; rather, unless bonded with a resin, the compressed fibers tend to fluff out filling any voids.

The fibers do not pick up more than an infinitesimal amount of moisture from humid air (a fraction of one per cent by weight). Water will wet only their surfaces. Insulating wools dry out rapidly after wetting, if drained and vented to the air, because the water can only gather in the interstices of the material and is not absorbed within the fibers themselves.

Fibrous glass thermal insulation is one of the group of mineral wool insulations, including rock wool and slag wool, with which applicators and users have been familiar for a half century. Its application[a], shown in the accompanying photographs, involves no departure from familiar practices. It is light in weight, easy to handle, easy to cut or fit to required shapes or sizes, and holds together well while being applied. One make of this material is called Fiberglas, on which specific data on characteristics and applications in power engineering are given below.

The fact that fibrous glass thermal insulating materials are efficient absorbers of sound has led to their wide use for the double purpose of providing a barrier to the passage of heat and reducing noise. When installed immediately behind a perforated surface of metal, asbestos board or similar material, a noise reduction factor as high as 0.95 may be obtained, the exact figure depending upon the form, thickness and density of the glass fibers, the type of finish, and the method of installation.

The batt, roll, bulk and shredded forms of Fiberglas thermal insulation (Type TW-F) are suitable for use in all temperatures from sub-zero to approximately 1000 F. Batts and rolls are widely used in industrial ovens and building construction. The bulk form is generally employed as an accessory material, for stuffing or packing into odd spaces. The shredded form is used wherever pneumatic application is called for.

Fiberglas blankets—the basic form of Fiberglas thermal insulation faced with a metal-mesh facing—are used for the insulation of heated equipment such as boilers, tanks, industrial ovens, large ducts and breechings. Temperature limits are the same as for batts and rolls.

Preformed Materials

Fiberglas semi-rigid or rigid sheets or boards (Type PF) can be used in all types of low and medium-temperature equipment up to about 600 F., maximum. In equipment operating at temperatures above 450 F., the resin used as a binder disappears from the hot side, leaving a layer of unbonded fibers which fulfills its insulation function with unimpaired efficiency up to 1000 F., so long as it is enclosed by supporting surfaces.

Fiberglas boards accurately molded into cylindrical form provide a convenient and efficient material for insulating steam and other pipes. The molded pipe insulation is ordinarily used as in Fig. 2, for insulating steam and other pipes up to 8, 10 or 12 in. in size, and at temperatures up to 600 F. For temperatures up to a possible maximum of 1100 F., it is used as an outer layer of insulation in combination with an inner layer of high-temperature pipe covering. Sections are in 3-ft lenghts. Canvas is usually used for the finish covering.

Twelve-inch and smaller pipe sizes are insulated with molded covers in two segments, each a half cylinder. For larger sizes either three or four segments are used. That so few segments are required is highly advantageous from the application point of view, and is due to the ruggedness of the material which makes it possible to mold and ship large segments.

The blanket-type pipe insulation, Fig. 1, is designed for insulating pipes at temperatures up to 1000 F., in all sizes from 8 in. up. Faced on one side with a "straight-line" wire mesh, it is well suited for spiral riveted or spiral welded pipe. In the case of spiral riveted pipe, no molded sectional covering could be made to fit because of the protruding rivets and lap.

Sections are 2 ft long, measured on the wire. The light weight of the sections makes them easy to handle, even when large sizes are involved, or when working from ladders and scaffolding. The outer covering may be canvas or a cement finish.

A characteristic of particular importance possessed by the molded and blanket-type pipe insulation is the substantial elimination of heat loss

POWER PLANT

By H. R. Hogendobler

Chief Engineer, Owens-Corning Fiberglas Corp., Toledo, Ohio

Interlaced glass fibers can be formed into blankets, rolls, boards, blocks, molded shapes and applied like other insulations . . . Characteristics of low thermal conductivity, fire safety, low moisture absorption, sound absorption and others . . . Details of molded and blanket type insulation for piping at temperatures up to 1000 F . . . Composition and use of fibrous glass insulating cement . . . Uses as electrical insulator, especially in motor construction and maintenance . . . Fibrous glass bonded with silicone varnishes for wire insulation . . . Glass fibers for air filters have low frictional resistance and high degree of fire safety

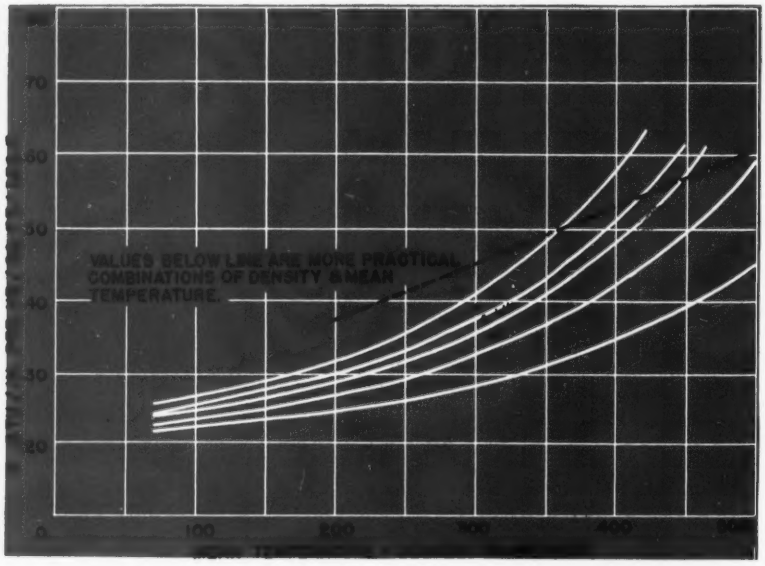


Fig. 5. Thermal conductivity plotted against mean temperature for Fiberglas insulating wool, Type TW-F. Figures on curves indicate density in pounds per cubic foot

through joints. Joints between sections fit or knit together so tightly that no path for the escape of heat is provided. The high thermal insulating value of the covering is uniform throughout the length of the pipe, once the insulation has been properly applied.

Insulating Cement

Fiberglas insulating cement is a plastic insulation material which may be used for almost any kind of equipment that produces or transfers heat. It is employed as in Fig. 6 for heat conservation, protection and finish on pipes, tanks and ovens at temperatures up to 1400 F. When exposed to the weather the cement is protected by a coating of mastic.

The cement is composed of pellets of Fiberglas in its wool-like form, combined with suitable refractory-type, plastic-forming materials. The pellets contain countless air cells. When the cement is applied, instead of collapsing into a heavy, solid body, it comprises a porous mat of dead air cells which assure low thermal conductivity. When applied in thicknesses of one inch or more, the cement is reinforced by 20-gauge galvanized netting between each one-inch layer of cement.

Handling Recommendations

Workmen handling Fiberglas thermal materials sometimes notice that unfiberized patrticles become superficially embedded in the skin. This is a nuisance characteristic common to all forms of mineral wool. Ordinarily such particles are easily removed by washing with mild, well-lathered soap and rinsing in flowing warm water. Dusting from the material is minimized by its fiber length, pack strength, and the bonding agents used with it. Specific handling recommendations made by the manufacturer include the following:

a. Keep work spaces as tidy as possible, disposing of trim and other scrap in receptacles provided for waste.

b. Wash well with mild soap and water before meals and at end of each shift.

c. Wear clothing loose at the neck, wrists, and ankles.

Says W. G. Hazard, U.S.P.H.S., acting chief of the Divison of Industrial Hygiene, New Jersey Dept. of Health:[3]

"1. Breathing glass fiber dust is not harmful to the lungs.

"2. Irritation of the skin is temporary, superficial, and not progressive.

"3. No special personal protective devices or clothing need be worn, except that in overhead applications of glass fiber, goggles are often desirable to protect against falling bodies.

"4. Frequent washing and a daily shower with soap and warm water will readily remove most of the small fibers clinging to the skin and will reduce any 'itching'."

d. Apply calamine lotion containing one per cent phenol to skin surfaces, if bothered. Available at most First Aid stations or any drug store, this lotion will help relieve discomfort while becoming accustomed to handling the material.

e. Use a clenser containing a wetting agent (e.g., Lan-O-Kleen or pH6) for removing fibers that cling to the skin.

Millions of man-hours of exposure to Fiberglas insulating materials have been accumulated by thousands of production workers who have manufactured, fabricated, or installed these materials since 1931. The manufacturer's insurance underwriter reports that no occupational hazards different from those in any normal manufacturing operation have been encountered, and no disablement attributable to such exposure has been validated.

Electrical Forms and Properties

Glass textile fibers—continuous filament and staple—are the basis of all forms of fibrous glass electrical insulation. Length of the continuous filaments is limited only by packaging requirements. Staple fibers vary in length from 8 to 15 in. Average diameters range from 0.00005 to 0.00038 in. The fibers are twisted and plied into yarns which in turn are

(Continued on page 122)

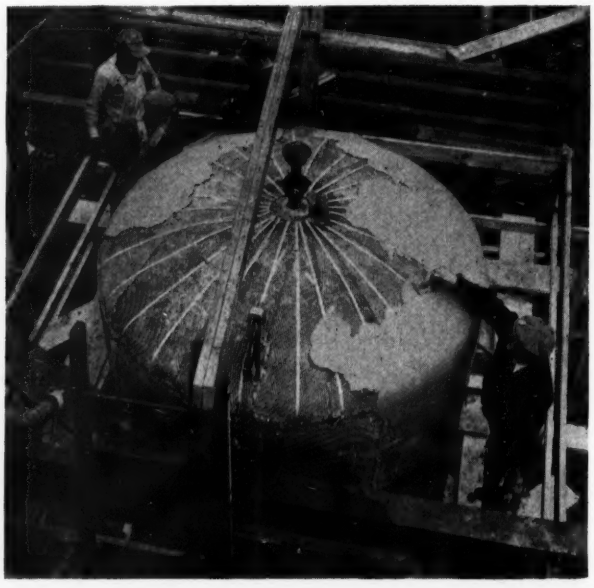


Fig. 6. Applying Fiberglas insulating cement over Fiberglas metal-mesh blankets

The PRACTICAL ENGINEER and ELECTRICIAN

ANDREW W. KRAMER, EDITOR

Life on an Atoll

Many times during these hectic years of editing The Practical Engineer & Electrician Section, the editor has had fleeting dreams of living on an island, an atoll maybe, far away in the Pacific. There, he figured there would be nobody to bother him with questions about operating boilers at 28 in. Hg of vacuum or other things equally silly. There would be no Pulverizer Pete (Heaven rest his soul, wherever he is) to worry him about the effect of solid CO_2 in the flue gas, and there would be no Arthur Parkers bombarding him with weekly letters asking how to keep pesky deer out of vegetable gardens. There would be none of these things. Instead, life would be calm and serene. He could lie on the beach, in the sun, with a book and quite possibly a Tom Collins—there might even be dancing native girls.

Well, curiously enough, your editor is having his dreams come true. He is going to have a chance to see what life on an atoll is like. By the time you read these lines he will be out there, on an atoll, but even now he is beginning to realize that life is not going to be all it has been cracked up to be; at least not on this particular atoll. Because, this atoll is Bikini atoll and it is no violation of security regulations to imply here that it is going to be anything but calm out there. It seems they have turned the whole place upside down, even evacuated the native girls. Then, they are going to shoot off a couple of atomic bombs. In short, it doesn't sound good, but it's too late to back out now, so your editor will make the best he can out of it. He will have a chance to study Practical Atomics with a vengeance.

While he is away, the Practical Engineer Section will be in the capable hands of Tom Hanson, who goes by the title of News Editor but anyone around here will tell you that he has a nose for things far beyond mere "news." So, you can tell him your troubles—a few sleepless nights won't do him any harm; he has just come back from several years in Uncle Sam's Army. Au revoir. A. W. K.

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Fatigue Cracks in Retaining Rings of Turbine-Generators

Many of the recent failures of turbine-generators have been found to have resulted from fatigue cracks in the retaining rings of the generators. In this article, which appeared originally in "The Locomotive" published by the Hartford Steam Boiler Inspection and Insurance Co. Mr. Swering discusses the nature of such fatigue cracks

By J. B. SWERING

Chief Electrical Engineer
Hartford Steam Boiler Inspection and Insurance Company

A STUDY of the increase in accident frequency with respect to turbine-generator retaining rings indicates that the majority of failures of this kind are due to fatigue cracking, and the particular study also shows that all of the failures occurred in connection with units having capacities not exceeding 12,500 kw. The cracking itself seems to result principally from seriously unbalanced polyphase loading of the generator, or from single-phase operation. There is a possibility, however, that frequent and substantial fluctuations in load may set up damaging disturbances in the magnetic field and lead to abnormal surface heating of the rotor, and that this in turn may lead to local heating of the retaining ring.

Many of the smaller power plants of the country lack adequate metering equipment and it is often found that there is only one ammeter provided for use with each generator, with no means for reading the current in each phase of the generator in order to determine whether the loading is balanced. Other installations include ammeter switches that permit the current to be read in each phase, but in many instances operators have been neglecting to record the various readings in the station log, to compare them and to appreciate their significance. This situation, of course, may result in just as much difficulty as if the ammeter equipment itself were inadequate. A turbine-generator may operate for years without any indication of trouble and then suddenly, due to system disturbances, be subjected to unbalanced load conditions which may result in damage to the generator rotor.

It is necessary that load conditions be kept balanced within permissible limits if damage to the field is to be prevented. If load conditions have been decidedly unbalanced on a generator, the field should be removed and a thorough examination made of the wedges and retaining rings. In spite of the fact that a completely assembled rotor of a turbine-generator is a most difficult part to inspect properly, a careful examination may in many instances reveal dangerous physical conditions if the inspector is trained to examine all locations where defects are most apt to occur. Such an examination will, furthermore, usually reveal whether the unit has been operated at dangerously unbalanced polyphase loading or has been subjected to harmful single-phase operation.

Fig. 2. The view above shows different parts of the same rotor of a 3000 kw turbine-generator that had been subjected to single-phase loading or operation with badly unbalanced phase current. The view at the left shows where two field wedges had become so overheated as to weld themselves to the retaining ring, later pulling apart. The other view shows a dangerous crack in the retaining ring which had been so heated that it had bulged out-of-round, both on the side where the crack was found and diametrically opposite

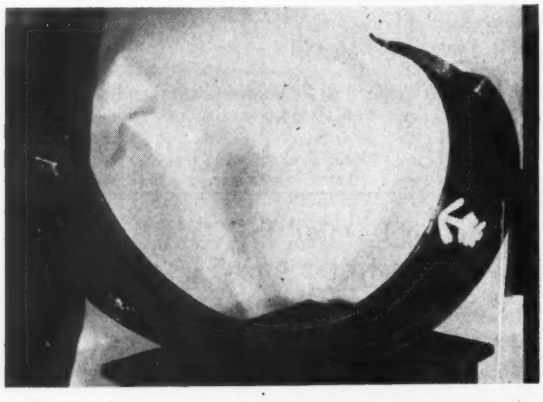


Fig. 1. Portion of retaining ring from the rotor of a 2000 kw turbine-generator that failed while the machine was being synchronized with outside power. The failure was the result of localized heating which started a fatigue crack which then became progressive and continued until the retaining ring became so weakened it broke from centrifugal force at normal speed

Experience indicates that many plant men do not fully understand what takes place when turbine-generators are operated at unbalanced loadings, and yet such an understanding is important to a realization of the consequences that may follow.

When a 3-phase generator is operating with all phases balanced, the current in the armature produces a constant wave of magnetomotive force (mmf) which travels around the air gap at the same speed as the rotor and in the same direction. If, under such conditions, the armature current is increased, it is merely necessary to increase the d-c field current in order to maintain constant armature voltage.

If the armature phase currents become unbalanced, the mmf wave ceases to be constant. Pulsations then are set up in the original wave and a second one is produced. This wave

Fig. 3. View of damage done to laminations and slot wedges of rotor forming part of a 1250 kva turbine-generator. Several wedges and rotor laminations were severely burned, and discoloration of the rotor showed the characteristic effects of overheating. The unit had been paralleled with outside power, and during an electrical storm one phase of the outside power line failed. This failure imposed a serious unbalanced phase loading on the generator with results as noted

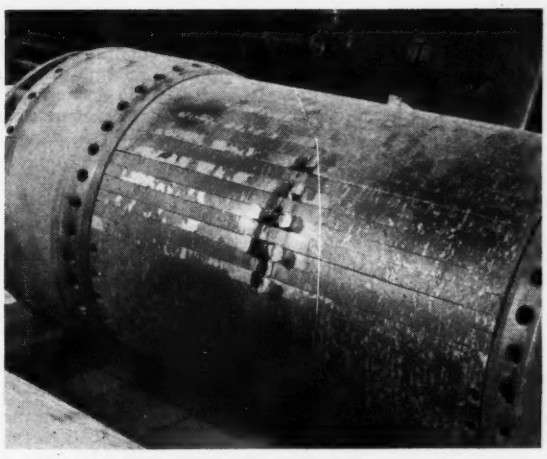


Fig. 4. Rotor of a 750 kw turbine-generator as it was found during inspection for purchaser who was looking for a used machine. Initial inspection made during operation revealed varying insulation resistance values at varying speeds, and the unit was dismantled for further investigation. The picture shows only one side of the damaged rotor but conditions were similar on the other side

also travels around the air gap at the same speed as the rotor but in the opposite direction. Voltages of twice normal frequency are therefore induced in the rotor surface; for example, 120 cycles in a 60 cycle generator. This double-frequency induced voltage will cause currents to flow in all closed electrical circuits on the rotor. In the case of a solid core rotor these circuits usually include the slot wedges, the rotor surfaces and the windings. In the case of a laminated rotor, the circuits include the slot wedges, the retaining rings and the windings. The resistances of the various circuits are not the same, and the largest currents will flow in the circuits of lowest resistance.

If a laminated rotor is operating under an unbalanced phase loading, the backward-revolving mmf wave links the parallel circuits of wedges and windings when the wave is directly over the rotor poles. The induced currents try to flow in the circuits linking the maximum mmf wave, but the windings form a relatively low resistance circuit and shield the circuit that is formed by the wedges. Therefore, most of the induced currents will flow in the windings, and the currents that follow the wedges will be relatively low.

On the other hand, when the mmf wave is moved backwards at one-half pole pitch in relation to the rotor, there is a tendency for the maximum induced current to flow along the pole. But because there is no circuit, the current is forced to flow in the wedges nearest to the pole, and the rotor winding then does not have the same shielding effect as it does in the situation referred to in the previous paragraph. The wedges nearest the pole will therefore be most likely to suffer from overheating under unbalanced phase loading.

On fields where the retaining rings fit over the wedge ends, there is a contact area between the wedge ends and the retaining ring. Usually this area constitutes a high resistance point in the circuit and when the induced currents become too high, heating and burning will occur at the contact area. Both the wedge and a small section of the retaining ring may be heated enough to cause a change in structure, or they may actually melt.

Any abrupt changes in grain structure will affect the endurance limit of parts that are subjected to alternating stresses in operation. After overheating, the ends of the wedges may break off under the retaining rings and deep cracks may start in the rings. Most of the cracks take a roughly semi-circular shape, and small sections of steel eventually break out of the rings. In severe cases, however, the cracks may result in the bursting of the retaining ring. An accident of this kind may cause extensive damage and even destroy the entire machine. There is also the possibility of personal injury or loss of life.

In some of the older laminated fields that have sectionalized rotor wedges with fiber insulation pieces between the wedge ends, the induced currents do not have a continuous path. The current therefore flows through the sectional laminations at the wedge ends in order to get past the insulation pieces, and this results in burning of the laminations and wedges. If the phases have been badly unbalanced with consequent high values in induced currents, sections of the rotor laminations and wedges may actually melt, as shown in an accompanying photograph.

Usually in solid core fields, the retaining rings do not make contact with the core portion of the field although in some designs the wedges are in contact with the retaining rings. The effect of unbalanced loading on this type of rotor is usually the breaking out of semi-circular shaped pieces of the retaining rings.

In several instances rotor retaining rings have been damaged as a result of single-phase loading of the generator caused, in turn, by a fault in the switch yard. There may be such an occurrence even though the generator is equipped with differential protection, because a fault may occur outside the effective limits of the differential protective system.

Whenever an inspection of a generator reveals cracks in the retaining rings, semi-circular-shaped pieces broken out, cracked wedges, or heated areas, the retaining rings or other damaged parts should be replaced at once, and the load conditions that have caused such occurrences should

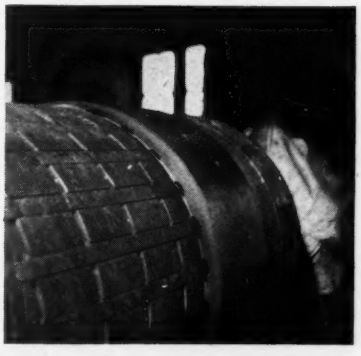


Fig. 5. Rotor of 5000 kw turbine-generator that was operated in parallel with outside power. On a routine inspection, overheated areas were noted at the lips of the retaining rings directly over the ends of the wedges. On the collector ring end shown in the photograph, several cracks were found in the ring in the overheated areas, the location of these appearing as dark spots in the picture. Investigation revealed that one phase of the outside power had open-circuited, this imposing an unbalanced load on the machine with results as noted

be determined and corrected. Furthermore, if it is ever found that a turbine-generator is operating at more than 10% unbalance at normal full load, the manufacturer of the generator should be consulted. If the percentage of unbalanced current that is observed in connection with a particular machine is greater than the permissible percentage for that machine, the unit should be shut down and arrangements made for a careful inspection of the rotor before it is run again.

Operating Experience in Great Britain

By EARL MORAN

Station Combustion and Efficiency Engineer

AMERICAN AND BRITISH power plant practice has certain technical differences. Whereas American engineers have favored reheating cycles when employing high pressures up to 2500 psi, British engineers favor lower pressures up to 1600 psi with higher superheat temperatures up to 960 F. The use of forced circulation boilers in America has only recently been tried out, whereas a considerable number of such boilers are in use in Britain. Topping plants are very rare on this (the European) side of the Atlantic.

It would appear that operating conditions are somewhat different in our two countries, and it may be interesting to consider some British operating experiences.

Staff

There are several large electricity supply companies who often control a considerable number of power plants, whereas a large number of stations are owned by the borough councils of the large towns.

There are many different arrangements of staff and their duties in these various stations, but a fairly representative staff "tree" is indicated in the scheme shown below:

It will be seen that the staff is split into three main groups of operation, maintenance and administration. Each group is under the supervision of a superintendent, and the whole staff is under the general supervision of the chief engineer and station superintendent.

British practice is generally inclined towards lower pressures compared with American standards, so that 650 psi and 850 F is a common condition but several higher pressure plants have been working for several years, employing both natural and forced circulation boilers with superheater outlet temperatures up to 960 F.

With the exception of one or two plants, all power plants are under private ownership but the development of plants is under the direct guidance of the Electricity Commissioners who are a Government Department of 5 people. The Central Electricity Board are directly answerable to, and carry out the policies of, this Department.

The distribution in bulk of electricity is by means of a national Grid System which is operated by the Central Electricity Board. The bulk of this transmission is at 132 kv. The power stations are connected to this grid system and in order to operate this network to the fullest advantage of the country, the position, size and extension of all stations is carried out under the supervision of the Electricity Commissioners. Whereas station owners may submit power plant schemes, these plans must be fully approved by the Commissioners.

Loading

The National Grid System can be operated as one complete interconnected system—a feature which was very advantageous during wartime conditions in that it stood up particularly well to blitz conditions and maintained supplies.

The brief but concise outline of power plant operating practice in Great Britain should be of interest to American operators. Despite the general similarity of plants in Great Britain and this country, there are certain differences and these differences make for differences in operating procedure. As the author points out pressures used in England are somewhat lower than those used on this side of the Atlantic and there has been a greater use of the forced circulation type of boiler. One of the reasons in the author's opinion, why the higher pressures are not favored in Great Britain, is the fact that high pressure demands the use of higher skilled labor than is generally available. There seems to be no system of proficiency certificates whereby operators can advance to the post of charge engineer. As a consequence operators exhibit little interest in acquiring greater skill and understanding in the running of the equipment

The Grid Network is divided into several regions and each section is under the direction for loading requirements of a control center. These centers are in touch with each other and also with all the power stations within their area.

At each control center there is a similar arrangement as in a normal station control room with mimic diagrams, instruments, etc., but directions for operations only are carried out, and the operation of switchgear etc. are carried out at the power plants or switchyards themselves.

Based upon records submitted by all power plants, and upon prevailing climatic conditions at the time, probable system loadings can be readily estimated, and generation requirements from day to day telegraphed to power plants up to 8 hours in advance. Subsequently, load changes are made accommodated by adjustment in station loadings. These load changes are made irrespective of local load requirements since import or export of a power station is absorbed or supplied by the Grid System.

It is of interest here to note that all electricity generated is sold to the C. E. B. based upon its actual cost of production. Supply authorities who may themselves be power station owners, buy back their requirements based upon special tariffs.

Thus the C. E. B. performs the duties of a major collecting and distributing authority.

Operation

Having outlined the controlling authority, the operating conditions prevailing in a station will now be more easily appreciated.

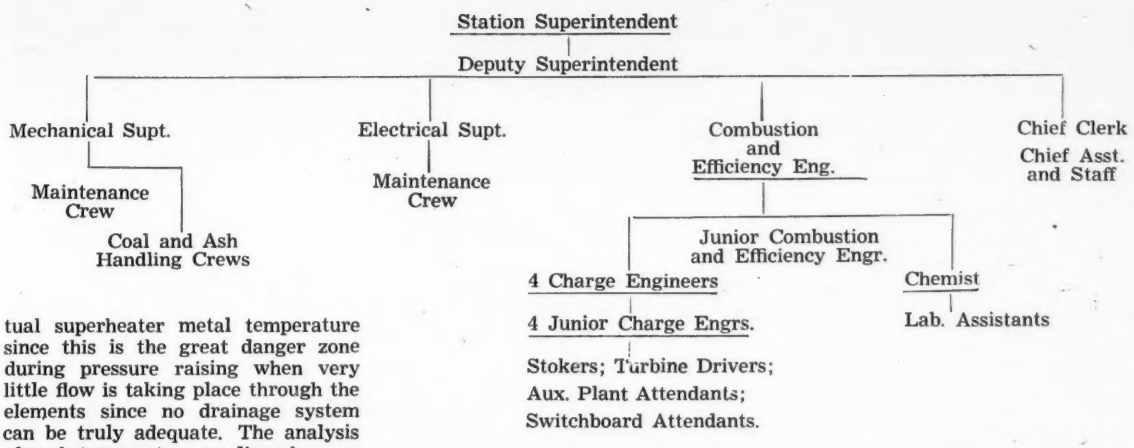
Many stations, particularly the larger ones, are operated as base load plants with the smaller plants being operated to meet load peaks etc. Efficient smaller stations are often included in this peak loading since they are able to carry out load changes and still compare well in efficiency with base load plants.

However, the loading program of many plants means a 2-shift operating cycle with turbines actually being shut-down completely about midnight until 6 or 7 o'clock in the morning. This condition applies to stations up to 120 mw (120,000 kw) and involves a considerable amount of work to shut-down and start-up again.

Firing

Boiler plants appear to be fairly equally divided over here between pulverized fuel and stoker firing with chain grates, etc. The technical difficulties with banking or grate equipped boilers and with pressure raising in pulverized fuel and grate fired boilers have needed close attention.

A difficulty which has been experienced with all pressure raising procedure has been minimum firing rates particularly with pulverized fuel plants. This problem has been tackled by investigators on boilers of the ac-



tual superheater metal temperature since this is the great danger zone during pressure raising when very little flow is taking place through the elements since no drainage system can be truly adequate. The analysis of such temperature readings has enabled maximum grate speeds and fuel bed thicknesses to be laid down for grate fired boilers, and maximum firing and standing periods with pulverized fuel boilers to be likewise determined. Provided these rates are not exceeded, a fair insurance is secured to prevent overheating of the superheater elements at least due to pressure raising conditions.

A particularly irksome procedure has been the banking of high pressure boilers of say 1500 psi and 150,000 lb per hour evaporation, which in 4 to 5 hours will lose 800 to 900 psi if natural circulation boilers or 1000 to 1200 psi if of the forced circulation types. In fact, banking procedure is often less economical than a complete burn-off and relight again since very little pressure difference results, and in the case of forced-circulation boilers, the circulating pumps which have to be run if there is a banking fire on the grate means an additional loss.

Fuel

Coal supplies are again controlled by a central department of the Government so that private barter for coal supplies is not possible. Weekly amounts of fuel are allocated to the various stations, and unless serious operating difficulties are encountered such coals have to be accepted and utilized. This often means that plants are receiving coal from 50 to 60 colleries in a week, and such can vary from 6 to 30 per cent ash, 10 to 20 per cent volatiles, etc. The mixture of such coals cannot often be avoided particularly when some coals arrive in very small amounts but such amounts are very apparent when fired!

Cleaning of Boilers

Soot blowers using superheated or saturated steam are used; these are very frequently operated in sequence by electrical control. In the furnaces the retractable single nozzle type are used but there is some doubt in the author's mind if furnace blowers are really necessary particularly in natural circulation boilers. In forced circulation boilers a dirty combustion chamber will mean abnormal superheat temperatures and subsequently reduced blower output. Economizers are usually blown by multi-jet retractable blowers but it is very frequently found that these boilers need only be operated weekly or even monthly since gilled-tube economizers are found to be largely self-cleaning. In the case of stoker-fired boilers, soot blowing has been found detrimental where bond deposits are encountered.

The zone of boilers which usually needs the most attention is the front bank of superheaters. Soot blowing has not always proved effective so that water-spray lancing has been used. A compressed air lancing has also proved effective in removing slag accumulations. It has been found

"Oh don't be absurd, Westgate—what would an octopus be doing down here?"

that after water lancing has been carried out, a very thin white film remains on the elements which cannot be removed but which does not appear detrimental or to increase in thickness with subsequent lancing.

A load lancing can usually be carried out without appreciable reductions in boiler loading.

Off load cleaning is frequently carried out by soaking the tubes with water sprays for several hours which may amount to 2 days in the case of bonded deposits in economizers. This water washing is very effective and after use, the tubes are perfectly clean right down to the metal. In the case of bonded deposits in economizers, it is found advisable to test the water from the tubes to make sure that it is not acidic since it is often found that unless this precaution is not taken, a thin film of sulfuric acid will remain on the tube surface and form ideal conditions for the rapid formation of further bonded deposits.

When water washing is being carried out the grate surface is usually covered by a tarpaulin which collects the drainage water which can then be led away to nearby drains.

In general the off load cleaning of stoker-fired boilers has to be carried out much more frequently than with pulverized fuel firing.

Turbine

Turbines vary in size up to 100 mw (100,000 kw) but a very popular size is 30 mw (30,000 kw). As was stated previously, the larger stations usually operated at base load, whereas others operate according to loading requirements. This means that many stations operate on a 2-shift cycle; in some areas this 2-cycle operation is shared in turn by the stations in the area.

This 2-shift operation presents many problems particularly with the higher pressure stations which are not suitable for overnight shut-downs. In these cases the loading is usually reduced to ⅓ overnight which can be fairly easily accommodated when more than one boiler supplies each turbine.

The rigors of 2 shift operation are particularly noticed in the steam and feed range joints. While welding has been carried out quite a great deal recently, flange-joints are still employed on valves. Consequently temperature changes due to shutting down and startng up exert a considerable strain upon such joints.

Conclusions

This is merely a brief account of some operating experiences in Britain.

Higher pressures as employed in the U. S. A., are not favored to such an extent in Britain. In the author's opinion this may be due partly to the actual operating staff themselves. The use of very high pressure does need the use of skilled workers. Too frequently firemen who have been in that category for a number of years find it rather difficult to adjust their ideas to more modern plants.

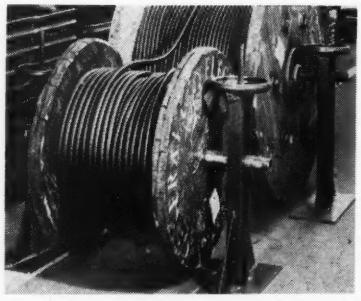
Unfortunately, in Britain, there is no system of proficiency certificates, etc., so that operatives have very little chance of promotion to the post of charge engineer. If such promotion was possible, and certificates had to be obtained before an operative could take over various power plant machines or boilers, it is felt by the author that quite a different class of personnel with subsequently greater interest and skill in plant operation would be employed.

The advent of gas turbines or whatever will replace steam boilers and turbines will certainly call for modifications in the choice and training of operatives here in Britain.

PRACTICAL HINTS AND KINKS

Jacks for Lifting Loaded Wire and Cable Goods

ONE INDIVIDUAL can easily handle heavily loaded wire or cable reels with a pair of the jacks illustrated above. Relatively easy to make from scrap materials usually available about the average plant, the jack consists of a base, two channel uprights, a yoke, and a handwheel rolled from pipe stock. The jacks, devised at General Electric's Pittsfield Works, facilitate handling of heavy spools and eliminate the hazards of manual lifting.



Showing arrangement for handling cable reels

New Use for Printer's Type Case

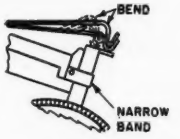
A DISCARDED printer's type case drawer makes an excellent box for an assortment of screws, nuts, washers, etc., in the home workshop. Simply mark each compartment, by means of a small paper label, attach a plain lid, to keep out dust, made of pressed wood, with hinges, and fasten the drawer flat onto a shelf near the work bench, with wood screws as shown.

Use the larger compartments for larger screws, etc., and the small ones for small articles. If the wood is varnished be sure to sandpaper the finish where the labels are to be pasted on to make them stick.

Brush Holder

By THOMAS TRAIL

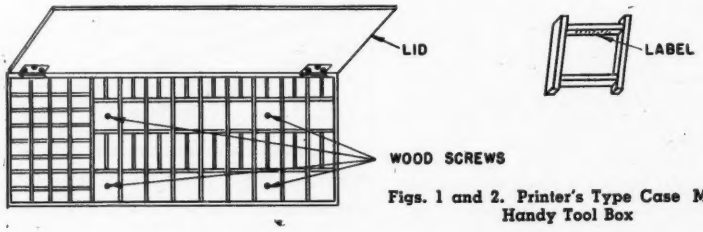
ON SOME D.C. MOTORS the brush holders are so constructed that only a somewhat narrow band of metal surrounds the brush on three sides, as shown in the accompanying figure. The brushes usually used in these brush holders are equipped with a metal plate that extends over the top and provides a surface for the brush holder arm to rest upon in maintaining tension on the brush.



Showing how springs on brush holder can be bent to effect better operation

As shown, the position of the brush holder arm, projecting over the edge of the brush top, throws a side tension on the brush which causes it to bind in this type brush holder.

A simple remedy is to bend the brush holder arm, as shown by the dotted lines, so it will rest on top of the brush more nearly in the center.



Figs. 1 and 2. Printer's Type Case Makes Handy Tool Box

The Boiler Fireman's Handbook

By J. R. DARNELL

Chapter XXIII. Flexibility in Firing Equipment and Problems Involved in Converting from One Fuel to Another

THE PARALYZING COAL strike of May, 1946, which seriously affected the operation of power plants all over the nation should serve as a warning to the plant owner to not "venture all his eggs in one basket." Complete dependence on one type of fuel may be disastrous. Prior to World War II many power plants were equipped for oil firing. When fuel oil was rationed to supply war needs, these plants were forced to convert to coal firing. Some continued to operate with coal even after V-J Day while others never operated with any kind of fuel except coal.

During the strike all plants which depended entirely on coal for power generation had to curtail their output in order to conserve their rapidly dwindling coal stocks. Since more and more control of our natural resources such as coal and oil is being centralized in the hands of a misguided bureaucratic national government there is no assurance that we will not jump from one crisis to another—first oil, then coal and perhaps six months from now another oil crisis.

Dual Firing Equipment

Power plant owners and managers should give serious thought to the problem of providing dual firing equipment. Some of the large oil refineries have their oil stills and boilers equipped with natural draft chain grate stokers which are mounted on rollers set on steel tracks. If there is a coal shortage or if oil prices drop, the stokers can be pulled out, the front wall bricked up and oil burners inserted in ports through the front wall. When oil prices rise or oil becomes scarce, the oil burners are removed, the front wall is torn out and the stokers are pushed back into place again.

As shown in Fig. 10, Chapter XX, some plants are equipped with combination burners which may be used for pulverized coal, oil or gas. Some plants have boilers equipped with stokers at the front and oil burners at the rear. Even those installations with underfeed stokers can be converted to oil firing without disturbing the stokers.

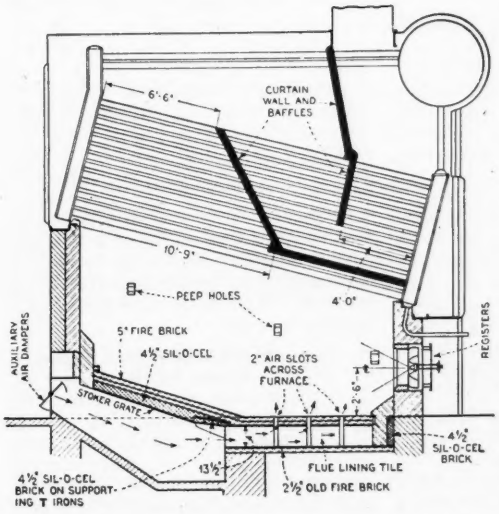


Fig. 1. This boiler was converted to oil firing without removing the stoker

Figure 1 shows how oil burners can be installed in the rear wall of a furnace without removing the stoker. The grates can be protected by brick and insulating material.

In the water cooled furnace shown in Fig. 2, oil burners are arranged to fire vertically upward through a refractory flooring built across the main supports of the stoker after removal of the side bars, troughs and tuyeres.

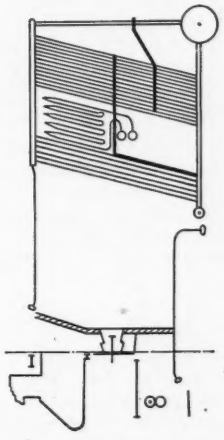


Fig. 2. In this water cooled furnace after the grate surface of the stoker was removed, oil burners were arranged to fire vertically through a refractory flooring

Boiler settings such as that shown in Fig. 5 of Chapter XV can be easily adapted to oil firing. This boiler is fired with a spreader type stoker installed so that whatever coal that does not burn in suspension falls onto horizontal grates. Since there is no bridge wall it would be a simple matter to insert oil burners through openings in the rear wall. Here again the grate could be protected by covering with insulating material and fire brick.

Figure 3 shows a separate pulverized coal burner and an oil burner installed in the front wall of a Heine boiler setting.

In Figure 4 a bent tube type of boiler is fired with a forced draft

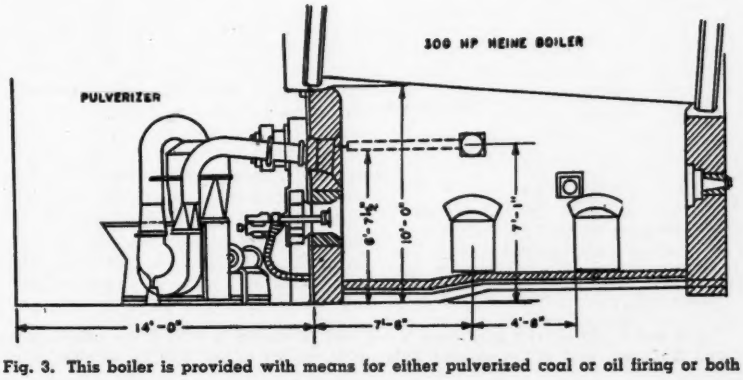


Fig. 3. This boiler is provided with means for either pulverized coal or oil firing or both

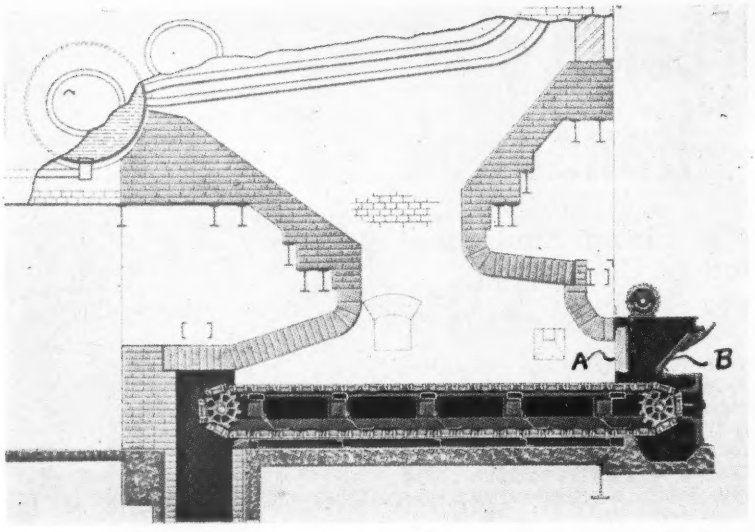


Fig. 4. Coal firing on a chain grate stoker such as this can be converted to oil firing by removing feed gate A, front apron B, covering the stoker with insulating fire brick and then installing oil burners through the wall replacing the feed gate

chain grate stoker. Since this type of chain grate stoker is not readily removable without complete dismantling, the quickest and most feasible method of converting to oil or gas firing is to remove feed gate A and front apron B from the coal hopper. The grate surface then should be covered with insulating firebrick and the opening bricked up in the front wall except for air ports and burner openings. If oil is to be used, burners giving a short flat flame will give the best results. Figure 1 of Chapter XVII illustrates burners having such characteristics.

In converting from coal to oil firing the hand fired installations shown in Fig. 5 presented a simple problem. As shown in Fig. 6, the grates, firing doors and ash pit doors were removed. The lower portion of the openings thus provided was then built up about 7½ inches above the floor and oil burners installed.

A simpler expedient and one which would have provided greater flexibility would have been to allow the grates, firing doors and ash pit doors to remain in place. With the grates covered with ashes, oil burners could have been installed in the front wall just above the firing doors. In such an arrangement, secondary air could be admitted through the coal firing doors while the primary air would be admitted through the burner ports. By lowering the height of the bridge wall about 18 inches there would be no impingement of flame on the bridge wall when oil firing and the lower wall would permit a greater area of the tubes to receive heat by radiation.

With such an arrangement, firemen could change from coal to oil firing or vice versa without shutting down the boiler. It is such flexibility that is needed in the firing equipment of all power plants. Ability to shift from one fuel to another without loss of time could have prevented the loss of millions of dollars in production in the great national coal strike in May, 1946.

In Fig. 7 the boiler normally is fired with an underfeed stoker but without any loss of time or change in load, firemen can switch to gas firing by means of burners installed in the rear wall.

Figure 8 illustrates the means adopted by one large central station to increase boiler capacity by supplementary gas firing. Four manifolds of B gas burners each are centered in air ducts projecting through the rear furnace wall. Although the original intent was to merely increase the boiler output, by burning both coal and gas, the whole load could be carried by gas if coal were not available. When burned in combination with coal firing the gas accelerates the ignition of the low grade coal used, reduces coking troubles and by taking away a considerable volume of hot air from the main air duct, reduces the temperature of the air to the stoker.

In another large central station normally operated with pulverized coal firing, during the coal strike mechanical oil burners were inserted in the opening alongside of the pipes supplying gas for igniting the pulverized coal. This, of course, was a temporary expedient but with a few ad ditional changes could have been constructed as a permanent installation with oil burners always ready for standby service.

Economic Problems of Dual Firing

Storage Space

In constructing a plant for burning either coal, oil or gas or combinations of these fuels or in making temporary conversion, adequate storage space for coal and oil is important. Coal storage has been discussed in Chapter

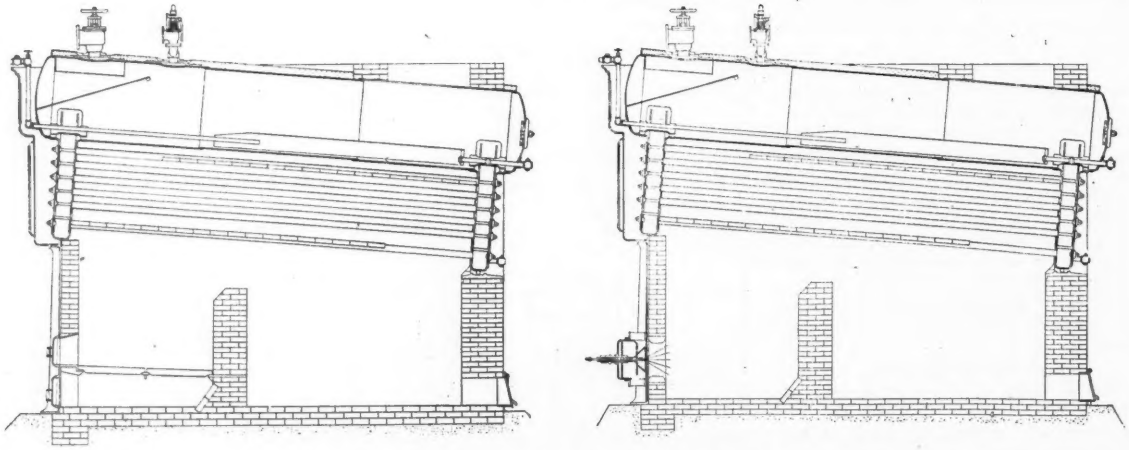


Fig. 5 and 6. To convert from hand firing coal as shown in Fig. 5, the grates, firing doors and ash pit doors were removed and the lower part of the opening built up about 7½ inches and oil burners installed as in Fig. 6

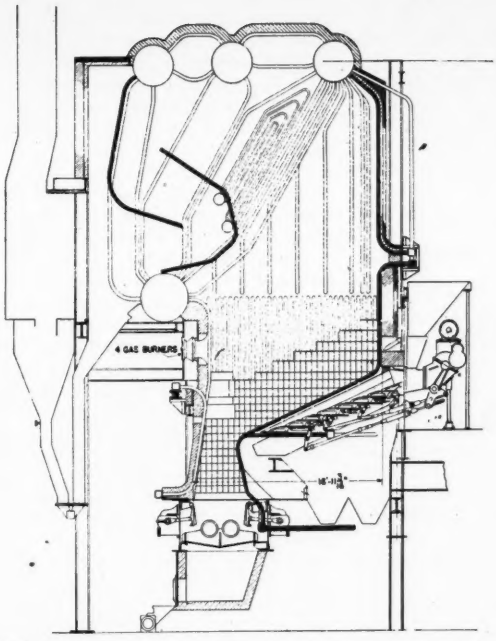


Fig. 7. This boiler normally is fired with an underfeed stoker but can be switched to gas firing with burners installed in the rear wall

VI but no mention has been made of oil storage. Since the storage of large quantities of oil involves much more of a fire hazard than coal, tanks should be erected in open surroundings with ample space between each tank. Concrete or earthen dikes should be built around each tank.

For economical operation, the heavier grades of fuel oil such as Bunker C, are usually used. Most of these oils are so viscous at ordinary atmospheric temperatures that steam heating coils must be provided in the tanks to facilitate pumping. For small plants, particularly in congested areas it is often necessary to erect storage tanks indoors if the fire laws do not specifically prohibit such constructions. To conform to fire laws, in some instances it may be necessary to install oil storage tanks below ground level. Both civic and underwriter codes should be consulted as to location and size of tanks.

Combustion Space

If originally a furnace was properly designed for oil firing there should be ample combustion space for coal firing. But if the original plans called for coal firing with no thought of future use of oil, the combustion space might be too small for efficient oil firing at all loads. This also might be said of gas firing in which high heat released are possible.

The amount of heat that may be released safely per hour, expressed in Btu per cu ft of combustion space depends on a number of variables but space does not permit any detailed discussion of this phase of furnace design. Different authorities from time to time have submitted tables showing average rates of combustion in various types of furnaces but such figures should be used only for general comparisons. For example, in a hand fired furnace the heat released per cu ft of combustion space might be 10,000 Btu per hr whereas in a stoker fired unit it might be 30,000 Btu. With pulverized coal the heat release might be increased to

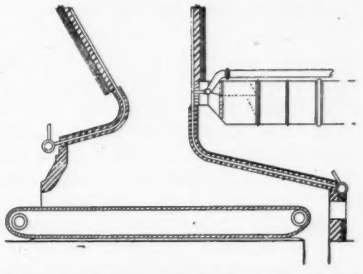


Fig. 8. Boiler capacity in this unit was increased by supplementary gas firing with burners centered in air ducts projecting through the rear wall

WEIGHT OF WATER IN POUNDS PER CUBIC FOOT FOR VARIOUS TEMPERATURES

DESCRIPTIONS OF A boiler installation frequently state the water capacity contained below the normal working level simply as so many pounds. Specifications accompanying inquiries for boilers often mention the minimum water storage capacity below working level and here again the desired weight of water is specified with no explanation as to whether this weight is water of room temperature or feed water temperature or saturation temperature corresponding with operating pressure.

The curve illustrates (on page 108 of this issue) graphically the weight per cu ft of water over a temperature range between 32 F and 705.4 F. The curve shows that the weight per cu ft of water is reduced with increased temperature. If, for example, water at atmospheric pressure and 212 F temperature is taken as 100 per cent the curve shows that one cu ft of water weighs only 70.8 per cent at 600 F, while at 60 F temperature one cu ft weighs 104.3 per cent.

It is clearly indicated therefore that wherever the weight of water is given this must be tied in with water temperature. It is preferable to state volume rather than weight to prevent all possibility of misunderstanding.

A boiler containing 1000 cu ft below the working water level requires 62,350 lb of water at 60 F to fill it to this level. If the water is of 212 F temperature, 59,800 lb are required and if the boiler drum pressure is 665 psig under load the water content would be only 49,000 lb, if it were assumed that all water below the working level is so-called solid water, that is, water entirely free of steam. This condition never exists while the boiler is delivering steam, but the example illustrates what is happening in the boiler while pressure is being raised prior to placing the boiler on the line. It also explains the gradual rise of water level in the boiler during the starting up period. If the boiler was filled to the working level with 60 F water and this level was maintained while bringing pressure up to 665 psig, the difference between 62,350 lb and 49,000 lb, or 13,350 lb of water had to be blown down. Competent boiler operators fill the boiler only to the lowest permissible level before lighting up to prevent unnecessary waste of water.

When a boiler is to be hydrostatically tested to check its tightness it is completely filled with water which is normally between 60 and 70 F temperature. Every part of the internal space of the boiler unit must be completely occupied with water including the superheater, all tubes, drums and headers. A boiler of 1000 cu ft water volume below the working level may have 1300 cu ft total internal volume so that over 81,000 lb of water at 60 F is required to fill the boiler for hydrostatic test. It is important to consider the weight of cool water used for hydrostatic testing when designing the supporting structure of the boiler.

40,000 Btu and with oil firing 50,000 Btu. With certain types of gas burners and furnace designs heat released far in excess of the above may be possible. A competent combustion engineer should be consulted if a change from one type of firing to another is contemplated.

Draft and Chimney Capacity

In contradistinction to the question of combustion space a furnace designed for coal firing with stokers o by hand should have ample draft with oil firing since with the latter there is no fuel bed resistance. However, it is possible that under certain conditions the diameter of the chimney might be too small for oil firing if the chimney had been designed for coal firing since with the former not only can a greater quantity of fuel be fired but there will be a greater weight of flue gas per pound if fuel for the same percentage of excess air. See Tables I and II, Chapter VII.

Methods of Using and Placing Gin Poles

By H. B. McDERMID

As indicated by the author of this article very few men in maintenance crews know very much about rigging. It is for this reason that the hints given in this article should be valuable; they are practical and were accumulated in the hard school of experience. Mr. McDermid did most of his own rigging while erecting power plant machinery for a period of 12 years with Stone & Webster, where, as he says, men not only know what knot to tie for a given location but know a lot of short cuts for tying them. For example, the clove hitch Mr. McDermid refers to in his article, can be tied in the bight of a line with one hand, without the operator even looking at the line, so fast that no one not familiar with the process can even guess how it is done. If a fellow does not know these short cuts on a construction job the author suggests that he had better learn them. His mates will make him look silly if he does not

IN THE HANDLING of heavy weights in many places where no regular apparatus is available for the job, or where there are no possible supports from which to suspend temporary hoisting rigs there are many instances where a gin pole can be used to advantage. It is surprising, however, to find so few crews of men in circumstances which would indicate their use, that know how to rig one quickly so that its use is justified.

Given the "know how," and materials, a crew should be able to raise a pole of moderate size in a matter of minutes and take it down with the same speed after using with complete safety. The use of such an outfit is in many cases a mighty handy proposition as well as a cost saver.

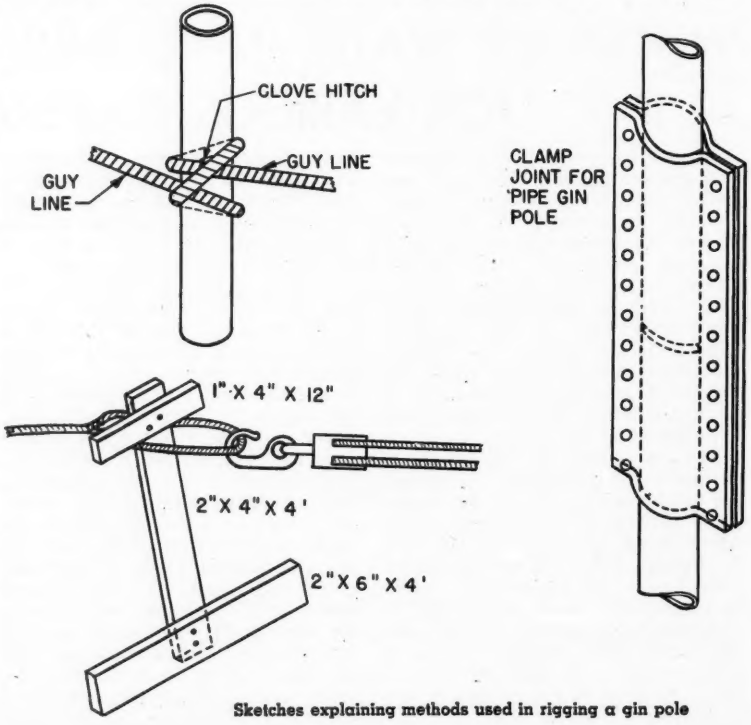
Often for light loads a gin pole whose main element is a piece of pipe say 20 ft long, of a diameter varying from 2½ in. to 4 in. standard weight, or better, extra strong weight is exceedingly handy. It usually can be had any place the work needs doing and is light to handle and strong. If more than one length is needed usually the situation can be met by screwing two pieces together solidly, if the job is not too heavy, or to be of long duration. If lots of heavy rough work is to be anticipated a strong clamp joint should be used. One steel company used a two-foot, quarter inch plate, wide enough to bend nearly half way round the pipe and formed to make two vertical flanges for bolts. One, of course, was used on each side of the pipe and when bolted up solidly formed a connecting joint that never gave trouble even in the tough job of erecting steel tanks at high speed in a highly competitive industry. (See sketch.)

Do not use the common threaded joint for rough heavy service, as it may break off under such conditions. Under moderate conditions threaded joints can be used safely. Wooden poles are all right if used within their limits of strength but are comparatively heavy. With wood care should, of course, be used to pick sound material.

To be handy, lines for guys are best used long enough so one piece of rope will form two guy lines; then the center of the line can be placed at top of the pole and a single clove hitch is the only knot required to fasten two guy lines in place. A second pair, drawing at right angles to the first pair, and fastened similarly with another clove hitch is necessary and can be put in place about as fast as one can read this.

A rope block is next attached to the pole just below the guy line knots with its lower block stretched out far enough so it can be reached from the ground when the pole is erected. (It is assumed that the above lines are to be attached to the pole while it is lying on the ground where it can be most easily done.) Of course, if lines long enough to use for two guy lines each are not available, single lines are just as good only they require more knots to attach. Four are required and safety laws in some states demand that there be five.

In raising a pole, too heavy to handle by ordinary hand methods, one guy line can be used as a pull line



Sketches explaining methods used in rigging a gin pole

from some high object within reach, or the block already attached to the pole top can be used from some high point to hoist the pole to its vertical position. Other guys are used to control the movements of the pole as it goes up, and of course, to fasten it in place after raising. The guy lines are used much to position the hoist block so the load can be landed or picked up to the best advantage and by slacking off one line and taking up another quite an area can be served. If required to do this under load strains it is well to have rope blocks attached to the lower end of each guy line to provide enough power to handle pole and load. These should be applied before the pole is raised so they are ready for use when the pole is erected. It will be found that when the strain comes on the guy lines, that the upper blocks will twist in a most unsportsmanlike manner, being out of reach and so inaccessible, unless means are taken to make them stay where they belong.

One foreman used to do it this way; a piece of 2 in. by 4 in. x 4 ft long was obtained and a piece of 2 in. by 6 in. x 4 ft nailed across one end of it at 90 degrees, the heavier piece being centered on the 2 by 4. Similarly, a piece of 1 in. by 4 in. x 1 ft. was nailed across the opposite end of the 2 by 4, parallel to the 2 by 6. When the guy line was rigged up, the one by four was slipped through the same loop in the guy line that received the upper hook of the rope block, so that when the system tightened up, the "monkey tail" as the boss called it, hung down from the block so far and was so heavy on one side that the rope twist was powerless to turn the block, and so make the whole rig inoperative. (See sketch.) Failure to so safeguard the rig can be tantalizing as one twisted block, inaccessible as they all are, can cripple the whole project but as described here the condition is easily taken care of. Care must be used in juggling guy lines, especially if the rig be heavily loaded as severe damage can be done by one careless fool. The writer once saw three guy lines on one side of a fifty foot pole all turned totally loose all at the same time, and the pole allowed to fall with a man on top of it. Old ¾ in. lines were being replaced by new 1 in. lines, and the steel load line was being used for further safety. Any one of the guys was enough to hold the pole with a large factor of safety — yet that crew of morons turned all holds loose and let the pole go over. The man on top rode the pole till about ten feet from the ground and then jumped and landed practically uninjured; but the blessing he handed that gang when he recovered his breath was a dandy, and one long to be remembered.

Often it happens that a pole must be raised that is too heavy to handle by hand and there is no high object from which to get a pull for hoisting the pole to its vertical position. Then the boss gets a chance to use some ingenuity; one method to be used is this. Set up a small pole which is light enough to erect by hand and with its hoist block get hold of your heavy pole at its balance, and with the rigging attached to the big pole and another line attached to its bottom end, hoist away as high as may be necessary, the big pole remaining horizontal; then with the line previously attached to its bottom end, up end the big pole and set it down, now standing on end, and secure all guy lines. Clear away the small pole and its rigging and the big pole is ready to go. Reverse the above operation when taking down.

Equipment Protection Involving High Resistance Faults

By C. O. von Dannenberg

THE DISCONNECTION and isolation of windings by means of differential relay schemes, when internal faults develop has reached a high degree of reliability. Occasionally, however, conditions develop indicating the need for supplementing the existing equipment.

The situation considered here includes a generator with the neutral grounded directly connected to a transformer bank which as indicated is delta connected on the generator side and star connected on the line side; the line oil circuit breaker is omitted for simplicity. The general arrangement is a conventional one as indicated in the appended diagram. The differential relays were set to operate at a minimum value assuming a fault in the winding at a point 10 per cent from the neutral point.

Due to local conditions there developed at one of the low voltage transformer terminals at "x," a flow of current to ground through a high resistance fault which was so small in magnitude that its existence was not indicated until it had developed into a fault damaging the cover of the transformer. The diagram indicates that the fault was outside of the range of either the generator or the transformer protective schemes. The flow of fault current was of course, from the point "x" of Unit I to the cover returning to the generator through its grounded neutral at "G." This current was so low in value that the balance of the differential relay winding concerned was not sufficiently affected to cause the relay to operate. Actual tests indicated this definitely.

To take care of such a condition a current transformer was inserted in the generator neutral ground connection at "C" connected to a low range over-current relay. This permits a setting independent of the differential relay equipment while tests indicated it would take care of the initial fault condition requiring its application. Future experience will show how low the relay setting can be maintained and also whether the sensitivity can be increased by making the current transformer at "C" of a lower current rating.

A similar arrangement could be installed for the line side by inserting a current transformer with relay at "H" as shown dotted, but this addition would require co-ordination with line-to-ground fault protective equipment for the transmission system.

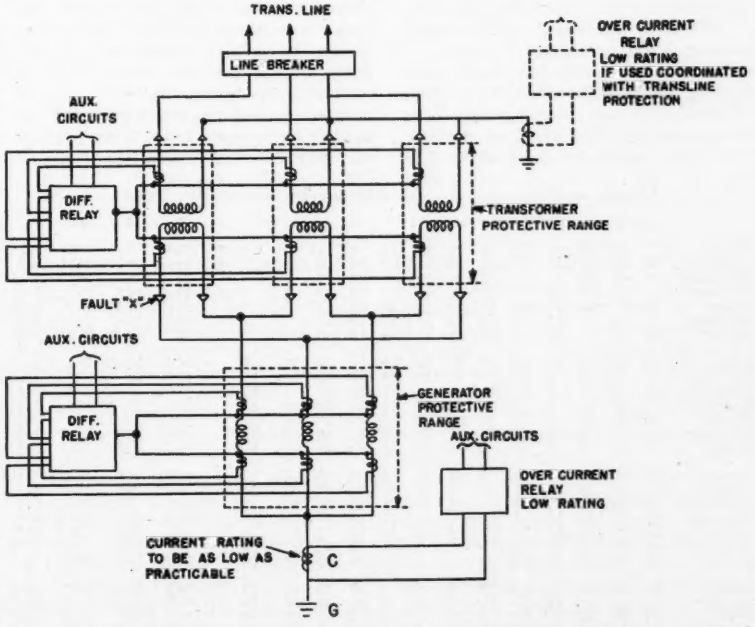


Diagram of differential protection scheme with high resistance ground fault auxiliary feature

LETTERS AND COMMENTS

Parks Replies to Comments on 5-Day Schedule

THIS IS answer to the comments on my 5-day, 40-hour work schedule:

In the May issue of POWER PLANT ENGINEERING, Glen R. Lytle commented (page 108) on my 5-day, 40-hour work schedule being in error.

It was my error in not stating that all men on the 7-3 shift work 48 hours a week and get paid for the same. This is true of all of the 5-day work schedules that I know of.

In regards to the starting time, when using this schedule, it is necessary to start the day's column with the day of the week that your week starts, as I stated when I sent it in. If your week starts on Thursday, as you suggested, then the schedule is reprinted so that Thursday will head the day's column instead of Monday, the day for which this schedule was designed, **but all other columns remain the same.** Then work according to the schedule. The only difference being the days off will be different than when it is used for any other day. Similarly, if anyone else has a different day for starting the week, then he merely starts the day's column with **his day** but leaves the other columns as **they are.**

I have enclosed another schedule that is used and has some advantages that I like about it. This schedule has the advantage of a long period off every four weeks and working seven days between days off the other weeks. This schedule is designed so that the current day starts at **12 o'clock midnight** so that when you come off of the 11-7 shift at 7 a. m. in the morning, that day's work is done. In other words, if you came off at 7 a. m. on Friday, May 24th, then your day's work for Friday, May 24th, would be done instead of it counting for May 23rd. When you come off at 7 a. m. on Friday, May 24th, you do not return until Wednesday, May 29th, at 3 p. m. This gives you an equivalent to 5½ days off every month, yet get the same 5 days' pay. It is a 5-day week for 4 operating crews rotating every week. When you go back to work, you work 7 days and have one day off, then work 7 days and have 2 days off and work 7 more days and have 4 days off (really 5½ days). I hope the above to be of service to you.

Baltimore, Md. CHAS. W. PARKS

How to Test Water in the Boiler Room

EVERYTHING pertaining to water treatment is of interest to me. Of particular interest was E. O. Davis' article in the October 1945 issue. The commentary from Mr. Fleming and Mr. Davis' reply in the February 1946 issue tend to bring out much-needed discussion of important controversial ideas.

I question very much the statement by Mr. Davis that boiler water should be kept between 0.1 gr and 0.5 gr hardness. I do not doubt that there have been instances where boilers have been kept free from objectionable scale under such conditions. However, in such cases it is likely that certain existent conditions made such trouble-free operation possible. ratings may have been relatively low.

The same may be said of the operating pressure. In fact, it has only been in recent years that phosphate conditioning has been advocated for pressures under 150 psi. Blowdown may have been high, or the boiler design may have influenced the results. It may be that coagulants absorbed the deposits or were present in the form of organic matter. Then again, there may have been periods when excess phosphates were present and the small amount of deposits were removed thereby. In fact, if little or no calcium were present, the magnesium salts would be converted to the hydroxide by maintaining proper alkalinity conditions.

Any number of things may have contributed to the prevention of the objectionable scale. Whatever the conditions, there is only one really safe rule to follow and that is to keep boiler water at zero hardness at all times.

Mr. Fleming correctly states that in boiler water "that has been properly conditioned and has a (soluble) phosphate concentration of from 40 to 60 ppm phospate (as PO-4), the hardness will be zero." Let me emphasize the term "properly conditioned" as regards alkalinity. Mr. Davis states that at the plant in question the "M" reading was maintained at 18 to 26 gpg. He failed to mention that the important element is to be sure that the "P" alkalinity is at all times greater than ½ M. Then the hydroxide is present, the magnesium is converted to magnesium hydroxide, and the phosphate to trisodium phosphate in which form it will readily react with the calcium present to form tricalcium phosphate. Also, the pH will be sufficiently high to inhibit corrosion. Most authorities agree that to fulfill these conditions we must maintain a minimum total alkalinity of 10 gpg with P always greater than ½ M.

In the last paragraph of Mr. Fleming's letter, he states "if we determine that the phosphate concentration is *above* 40 ppm, we know immediately that the hardness is zero." I believe that he will find that this will not always hold true if the foregoing conditions as to alkalinity are not met, or if phosphate concentrations are permitted to rise to unduly high levels. It is generally agreed that best conditions are assured when the phosphate is held between 30 and 60 ppm.

I believe that the use of the term "phosphate" should be clarified somewhat by referring to it as soluble phosphate or excess phosphate, so as to not confuse it with the tri-calcium phosphate resulting from the action of the tri-sodium phosphate on the calcium salts. This latter precipitate is insoluble and must be removed by filtering before making the usual phosphate test.

I have always thought it good practice to run a soap hardness test on the boiler water as a check, particularly when proper alkalinity conditions are not maintained, or when excess phosphate concentration is unusually high.

It should not be out of place to make a suggestion as to the method of feeding phosphates. Never introduce them to the feed lines except in shots, or deposits are likely to occur. These deposits usually make them-

Table showing another work schedule by Charles W. Parks

														A	B	CC	D
Monday		28	25	25	22	20	17	15	12	9	7	4	2	30	11-7	7-3	3-11	Off
Tuesday	J1	29	26	26	23	21	18	16	13	10	8	5	3	31	11-7	7-3	3-11	Off
Wednesday	2	30	27	27	24	22	19	17	14	11	9	6	4		11-7	7-3	Off	3-11
Thursday	3	31	28	28	25	23	20	18	15	12	10	7	5		11-7	Off	7-3	3-11
Friday	4	F1	M1	29	26	24	21	19	16	13	11	8	6		11-7	Off	7-3	3-11
Saturday	5	2	2	30	27	25	22	20	17	14	12	9	7		Off	11-7	7-3	3-11
Sunday	6	3	3	31	28	26	23	21	18	15	13	10	8		Off	11-7	7-3	3-11
Monday	7	4	4	A1	29	27	24	22	19	16	14	11	9		Off	11-7	7-3	3-11
Tuesday	8	5	5	2	30	28	25	23	20	17	15	12	10		Off	11-7	7-3	3-11
Wednesday	9	6	6	3	M1	29	26	24	21	18	16	13	11		3-11	11-7	7-3	Off
Thursday	10	7	7	4	2	30	27	25	22	19	17	14	12		3-11	11-7	Off	7-3
Friday	11	8	8	5	3	31	28	26	23	20	18	15	13		3-11	11-7	Off	7-3
Saturday	12	9	9	6	4	J1	29	27	24	21	19	16	14		3-11	Off	11-7	7-3
Sunday	13	10	10	7	5	2	30	28	25	22	20	17	15		3-11	Off	11-7	7-3
Monday	14	11	11	8	6	3	J1	29	26	23	21	18	16		3-11	Off	11-7	7-3
Tuesday	15	12	12	9	7	4	2	30	27	24	22	19	17		3-11	Off	11-7	7-3
Wednesday	16	13	13	10	8	5	3	31	28	25	23	20	18		Off	3-11	11-7	7-3
Thursday	17	14	14	11	9	6	4	A1	29	26	24	21	19		7-3	3-11	11-7	Off
Friday	18	15	15	12	10	7	5	2	30	27	25	22	20		7-3	3-11	11-7	Off
Saturday	19	16	16	13	11	8	6	3	31	28	26	23	21		7-3	3-11	Off	11-7
Sunday	20	17	17	14	12	9	7	4	S1	29	27	24	22		7-3	3-11	Off	11-7
Monday	21	18	18	15	13	10	8	5	2	30	28	25	23		7-3	3-11	Off	11-7
Tuesday	22	19	19	16	14	11	9	6	3	01	29	26	24		7-3	3-11	Off	11-7
Wednesday	23	20	20	17	15	12	10	7	4	2	30	27	25		7-3	Off	3-11	11-7
Thursday	24	21	21	18	16	13	11	8	5	3	31	28	26		Off	7-3	3-11	11-7
Friday	25	22	22	19	17	14	12	9	6	4	N1	29	27		Off	7-3	3-11	11-7
Saturday	26	23	23	20	18	15	13	10	7	5	2	30	28		11-7	7-3	3-11	Off
Sunday	27	24	24	21	19	16	14	11	8	6	3	D1	29		11-7	7-3	3-11	Off

selves known through faulty operation of feedwater regulators. When phosphate is introduced in shots it is followed up with sufficient phosphate —free water to enable the deposits to be washed out before they can become adherent. When it is desired to feed phosphate continuously it should be fed direct to the boiler drum through a separate line. The feeder should be set as close to the drum as possible. If this small line should eventually become incrusted with deposits, it can easily be replaced.

As to the use of the different types of phosphates, operating conditions dictate which is the most desirable. Whether you feed meta, mono, pyro, or di-sodium, the final product in the boiler is tri-sodium. The reason that tri-sodium is not used originally is that it is highly alkaline, and one of the reasons for phosphate conditioning is that, in using it, water may be softened without any increase in alkalinity.

I trust that my friend, Mr. Davis, as well as Mr. Fleming will accept this friendly comment in the spirit in which it is offered.

W. J. WRIGHT

Kirkwood, Mo.

E. O. Davis' Reply to Wright

I NOTE THAT you can't quite agree with my statement in the October, 1945 issue that water in the boiler should be kept between 0.1 and 0.5 H. Well, I will change that and say boilers can be kept free from scale and carry over by maintaining H between 0.1 and 0.5 and by using an open heater, top ventilated to atmosphere, and water in the heater as near boiling as the pump will handle it, unless you are equipped with a deaerator. Don't be careless about when and how often you test the boiler water and water from the softener if you use one, make a check each shift then you are sure the fireman or water tender takes care of the blowdown and that the chemical treatment is where it should be. I am referring to boilers of 200 psi or less.

As for phosphate to be maintained in boilers, Bulletin 261, Scale Prevention in Industrial Power Plants of the University of Illinois, page 74 shows analyses of boiler water and pressure from 160 lb to 700 lb. The 250, 400, 450 and 700-lb plants were advised to use phosphate. However, they had operated one year or more, and one plant five years, free of scale without using phosphate treatment.

Phosphate treatment is not a cure-all for boiler water troubles, and it can get one in a lot of trouble, as you state, in regards to feed lines and regulators.

As my good friend Dan Gutleben told me when I visited him at the Pennsylvania Sugar Refinery, they changed their hot lime soda softening and phosphate pumped direct to boilers to caustic soda and phosphate as primary treatment, because they had trouble with calcium phosphate precipitate on economizer tubes and aggravated carry-over that fouled superheaters, valves and turbines. The phosphate pumps were then connected to their caustic soda tanks in case sugar should get back to the boilers through condensate return.

All sugar factories have a tank of hot caustic soda ready at all times in case sugar should get in the return condensate.

Your water test will show loss of alkalinity and I have seen it bad enough that water showed reddish brown in the water glass. So don't use red-line water glasses around plants that make anything containing sugar and that applies to breweries, as the wort in the brew kettle contains sugar and if the coil leaks you can get in trouble.

I know of a small brewery that had to shut down for 3 days and roll 506 tubes from this cause. That could have been avoided if the boiler water had been checked each shift and caustic soda pumped into the boiler as soon as the alkalinity did a nose dive.

Remember my October 1945 article was intended to help the engineer in small plants carrying steam pressures of 200 lb or less.

In your letter you mentioned that I left out the P reading, which should always show more than ½ of M. You are correct, and I am always glad to be corrected on anything I say. That way we all learn our mistakes.

EARL O. DAVIS

Speed Control of B. F. Pumps in English Station

E. EMERSON refers in the December issue to an English high-pressure generating station and among other comments, expresses criticism of the Ward Leonard variable speed drives of the reciprocating boiler feed pumps. As this equipment forms part of a Unified Boiler Control scheme and as the company responsible for the development of this system of control is Metropolitan-Vickers Electrical Co., Ltd., Manchester, England, the following comments may be of some value to Mr. Emerson and to other readers:

The main factors leading to the adoption of variable voltage d-c motors with reciprocating boiler feed pumps are primarily: the simplicity and accuracy of this type of speed control and secondly where boilers are equipped with Unified Control (see references below) and the feed pump reciprocating type it is practical and economical to include the pump in the co-ordination of the fuel, air and gas services as the quantity of feedwater is also proportional to speed and load change.

With Unified Control the speeds of all the service motors are adjusted by varying the armature supply volts to maintain constant steam pressure, in addition, the service motors are also equipped with speed regulation by field weakening for trimming, the extent of which on the feed pump motor is ± 20 per cent.

Water level, however, is very sensitive to load and pressure variations, this causes a tendency of the operating staff to trim very frequently, to relieve the personnel from this duty the trimming only should be automatically operated by the water level regulators and as the main regulation is co-ordinated in the Unified armature voltage control the ± 20 per cent is a much greater range than required.

J. W. YOUNG
Engineer in charge, Power Station Auxiliaries, Metropolitan-Vickers Electrical Co., Ltd.
Trafford Park, Manchester 17, England

References—British Publications: Engineering, May 26th, June 2nd, June 9th, 1933. Engineering, December 11th, 1942. Electrical Review, February 8th and 15th, 1946.

The Power Plant Goes to Sea . . . but the Supervision Stays Ashore

I READ the above named article by Mr. Lester M. Goldsmith, in the April issue of POWER PLANT ENGINEERING with great interest. I may have misunderstood what Mr. Goldsmith meant when he stated that "combustion control, feedwater control, dual control and so on, are not in use." By such a statement I understand that Mr. Goldsmith assumes that such equipment is not being used in its entirety aboard any *one* ship.

Being a Marine Engineer myself, I would like to ask Mr. Goldsmith if he has ever been aboard on any of the U. S. Army Mine Planters of the Knox class. Although these ships are not turbine driven, they do have two (2) 600 hp Skinner Unaflow engines for propulsion. I will agree that I have never come in contact with any ship that uses flow meters as standard instruments but the above named class of Mine Planters do have the Hagan Automatic combustion control. They are also equipped with automatic feedwater control, electric Salinometer indicators, draft manometers, oil pressure gages for main engines, oil temperature gages to and from engines, steam pressure recording chart too, main engines, and use the Dearborn system of feedwater treatment. They also have the latest in auxiliary equipment such as: surface condensers, electric circulating and condensate pumps, air ejectors, evaporators in conjunction with which they use electric driven pumps. Pressure filters with which they use soda ash and alum to coagulate the oil deposit that enters the pressure filter. They are equipped with an Elliott deaerating

heater. The above named equipment was mentioned so that the readers of POWER PLANT ENGINEERING will have an idea of how the Army is advancing in progress in regards to the latest Power Plant Equipment coming out.

As this is the first comment that I have submitted for publication and with due respect to Mr. Goldsmith, I have done so not with the idea to disagree but to state some of the equipment that I have come in contact with in the Marine field.

Stratford, Conn. ALFRED F. BAILEY

An Open Letter on the Boilers Act of Alberta

IN THE December issue of POWER PLANT ENGINEERING there appeared an article under the above title written by William S. White. This letter apparently was written by a contributor who has sent many articles to POWER PLANT ENGINEERING, all of which have been interesting and very good. From the way Mr. White writes, I have a feeling that he is probably one of the old-timers whom I have a great respect for because it has been through the efforts of men such as he that younger engineers in the field today have acquired knowledge and skill.

I quite agree with the opinions expressed in Mr. White's letter. The condition that he speaks of exists not only in the Province of Alberta, but in many of the largest cities in the United States. I know particularly of one city and that is the city of Philadelphia in which I live. Mr. White has my sympathy in his plea for a better license law but men of Mr. White's caliber do not want sympathy—they want action and they want quick action for an honest boiler act with proper individuals to run it. I believe as he does, that something should be done but politics besets us on all sides. It is really up to the engineers themselves to do something about the matter.

I can only make a few suggestions. If Mr. White wants action, he will have to get help and he would have to have the help of engineers that have an interest in the matter just as he has himself. If he could get several engineers together, then the province of Alberta could be divided into sections or areas so that each one of the engineers assisting Mr. White could get the name and address of every engineer in that section. Then letters written to these engineers would ask them how they felt about getting the law changed and suggesting possible action. If possible, direct contact could be made with each man and in this way a much better idea of how the men felt could be obtained.

Mr. White may be interested in knowing how the engineers' license law works out in Philadelphia. We have four grades of licenses for engineers and one for firemen. These are as follows:

(a) Engineers' license for steam and refrigeration.
(b) Engineers' license for electric refrigeration.
(c) Engineers' license for portable and steam shovels.
(d) Firemen's license.

The worst part about our license law is that if you merely know the right politician well enough you can get a license. Naturally I have heard engineers who obtained their licenses through political influence dispute this, but anyone who knows anything about the matter knows that it is true. Many of these engineers know very little about operating. It is only through the efforts of the inspectors from the insurance companies that many boilers are kept from taking off into the air like buzz bombs. Much credit goes also to the manufacturers of feedwater controllers, feedwater treatment and other regulating and control equipment. These automatic equipments keep the boilers in operating condition and within the limits of safety despite the carelessness of the operators.

The fact that such automatic control devices are installed should not make operators feel that they can remain off the job. They should be on the job at all times to protect life and property.

We engineers in Philadelphia tried to do something to get the license law changed in 1940, but the only effect of this rather meek effort was an increase in the cost of the license per year. Until the engineers as a body do something about these deplorable license law conditions it seems to me that there is very little hope to have anything changed.

Philadelphia, Pa. T. F. CUNNINGHAM

Don't Take Inspection for Granted

IN HIS ARTICLE on page 116 of the November issue, Mr. Slavinsky emphasized the point that a competent responsible person should personally check all work around a power plant to prevent possibilities of damage to machines or risk of injuries to employees.

This recalled an incident that came dangerously close to both on one occasion where I was working in a maintenance crew.

Our work required the use of a chain hoist. The hook of the chain-hoist was supposed to be in the bight of a piece of cable looped twice around an overhead beam. This had been rigged previous to my becoming a member of the gang, and I never thought that it was anything but O.K., particularly as the foreman in charge had held his position for several years with a good record of having had no accidents.

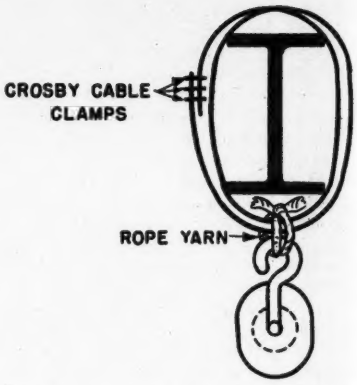


Fig. 1. This is how the hook was fastened to the cable

On completion of the work, the foreman ordered me to get the necessary tackle and take down the chain-hoist, and also remove the cable from the beam. When I climbed up to the chain-hoist, I saw that instead of the hook being over the two loops of the cable, it was suspended by a few loops of rope yarn, which by rights should have had barely sufficient strength to carry the bare weight of the chain-hoist alone, without the weights we had been lifting at intervals for a period of four months.

A check-up showed that he had ordered two young fellows to rig the chain-hoist late one afternoon. The cable was looped twice around the beam and the lapped ends secured by Crosby cable clamps, which was all right. When the time came to hoist the chain block, the man on the ground lashed the hook of the lower block of the tackle to the hook of the chain-hoist. (Fig. 2). When the chain-hoist was raised, the man up on the ladder found that he could not turn the hook of the chain-hoist over the cable and release his tackle. Instead of lowering the chain-hoist to the ground and re-rigging his hoisting tackle, the man on the ladder, finding he had some rope-yarn in his

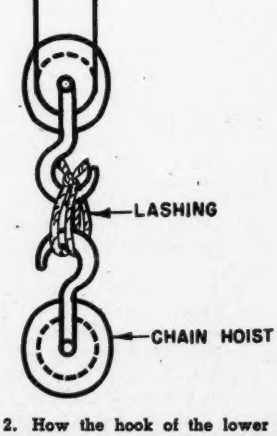


Fig. 2. How the hook of the lower block was lashed to the hook of the chain hoist

pocket, lashed the hook of the chain hoist to the cable. He then removed his small tackle from the beam to shift it to a better position to lift the chain-hoist. At this moment, someone on the ground yelled "Quitting time," so the man came down the ladder bringing the small tackle with him.

Next morning the two men completely forgot to properly rig the chain-block and the foreman, seeing the chain-hoist hanging from the beam and the small tackle down, took it for granted that everything was in proper order and had us start work.

While the job was in progress, the safety-engineer looked the job over, ordered a number of minor safety precautions to be observed, but somehow he never inspected the chain-hoist to see that it was properly suspended.

HOWARD T. LIVINGSTON.

Questions And Answers

Question No. 338

How Much Blast Furnace Gas Per Ton of Coke?

WE ARE INTERESTED in determining the amount of blast furnace gas produced per ton of coke fired to the furnace.

Average Coke Analysis:

Ash	9.5
Volatile	.5
Moisture	3.0
Sulphur	.52
Fixed Carbon	86.48
	100.00%
Btu	13200
Cell Space	55.7
Size	2.5"
Apparent gravity	0.829
True gravity	1.86

Also the per cent of loss due to leaks, castings, etc., and per cent consumed by these stoves.

Detroit, Mich. W. W. D.

Using some data recently given by Owen R. Rice,* it is possible to estimate the volume of gas produced in cubic feet per ton of coke. This depends on: 1, the fact that theoretically all the carbon in the coke is to be burned to CO and not to CO_2; 2, the percentage of carbon in the coke, given in this case; 3, the percentage of the coke charged that is burned at the tuyeres.

From the relation $2C + O_2 \rightarrow 2\ CO$ it is calculated that 75.2 cu ft of dry air at 60 F and 30 in. Hg (that is, standard atmospheric pressure) are needed per pound of **carbon** burned at the tuyeres. Using Rice's figures of 1.354 cu ft of gas formed per cu ft of air, we get $1.354 \times 75.2 = 102$ cu ft of gas per pound of **carbon.**

A table follows which gives cubic feet of gas per ton of coke charged over a range of percentages common in actual practice.

Per cent of Coke charged which is burned at tuyeres	Cu ft of gas (60 F, 30 in. Hg) produced per ton of coke (86.48 per cent C)
78	137,600
79	139,500
80	141,200
81	143,000
82	144,800

Sample computation:

Per cent of coke burned at tuyeres times per cent of carbon in coke equals pounds of **carbon** burned at tuyeres per pound of **coke** charged to furnace.

$0.78 \times 0.8648 = 0.674$ lb carbon per lb coke

$0.674 \times 102 = 68.8$ cu ft gas per pound of coke

$68.8 \times 2000 = 137{,}600$ cu ft gas per ton of coke

To determine the losses and the per cent consumed by the stoves, it would be necessary to compute a heat balance. This calculation would be of limited interest here and, besides, we are not sure that enough data are given for such a computation. Perhaps some of our readers in the steel mill field will show us how it is done.

*Some Characteristics of Blast Furnace Gas, by Owen R. Rice, *Iron & Steel Engineer*, February, 1946, p. 67.

Question No. 339

Can He Determine Iron in Ash by Appearance or Color?

THE COLOR of the residual ash after a calorific value determination of coal depends upon the constituents of the ash. The percentage of iron in ash has a very marked effect upon the fusion temperature of the ash.

I would like to know if it is possible to approximate roughly the percentages of iron or other major substances in the ash according to visual observation of the ash remaining in the crucible after determination of calorific values.

London, England E. E.

Question No. 340

How Fast Does a Wire or Rod Conduct Heat?

IF YOU HAVE a wire or rod of copper, steel (or any common material) of any definite length, say 20 ft, and at ordinary temperature, say 70 F; and if you heat one end of the wire or rod to some higher temperature, say 300 F, how long will it take for the other end of the rod to reach that same temperature of 300 F, assuming that the rod is perfectly insulated so that there can be no heat losses?

Chicago, Ill. W. S.

Answer No. 315

How Calculate Steam Flow Through Slots?

Parks Doesn't Approve Napier's Formula for This

IN THE December issue, J. R. D., asked how to calculate the flow through rectangular slots and about Napier's formula for such calculations. I did not get around to answering it then but I would like to offer a short discussion of the problem at this time.

In calculating the flow through orifices or openings, unless friction is considered, it is the same whether they are round or any other shape. The first item to be taken into consideration is the velocity, because this varies with the square root of the difference of the heat released in the expansion. The heat released is the difference between the initial and final enthalpy. When saturated steam is expanded to a lower pressure, it falls into the wet steam region, the quality of which depends on the final pressure. This is most conveniently plotted on the Mollier diagram. Taking the case at hand, 75 psi gage is 89.7 psi absolute; for convenience let us use 90 psia. The enthalpy is 1184.6 or 1185 Btu. After the steam has expanded to atmospheric pressure, assuming an isentropic expansion, the final enthalpy will be 1052 Btu.

The total area of the openings would be:

$1.56 \times 0.07 \times 2$ is 0.2184 sq in. or

$0.2184 \div 144$ is 0.0015166 sq ft

The velocity would be:

$$224\sqrt{h_1 - h_2} = 224\sqrt{1185 - 1052} = 2593 \text{ ft per second}$$

The specific volume of steam at 90 psia is 4.892 cu ft.

Then if we let:

w = lb per second; V = velocity in feet per second;

v = the specific volume and A = the area in sq ft, then

$w = AV \div v$. Substituting,

$w = (0.0015166 \times 2593) \div 4{,}892 = 0.8202$ lb per second or $0.8202 \times 3600 = 2952.72$ or 2953 lb per hour.

This, of course, is neglecting the coefficient or friction. This depends on the shape of the opening and the thickness of the metal at the opening but can be neglected except where exact figures are required. The above formula gives a value close enough for ordinary work.

Now, applying Napier's formula to the same problem where A is 0.2184 sq in. P is 75 then $(75 \times 0.2184) \div 70 \times 3600$ is 842.4 lb per hr.

The formula I used was taken from Marks' Mechanical Engineers handbook. By comparing the above values, it can be readily seen that Napier's formula cannot be used for this sort of a problem.

Baltimore, Md. CHAS. W. PARKS

Answer No. 328

Why Greater Pressure Drop with Live Steam than with Exhaust Steam?

He Thinks Exhaust Heat's Better, But Can't Prove It

G. H. K.'s problem of exhaust heating as compared to live steam heating raises the question of quantity for each.

It is claimed by old-time engineers who are in a position to know that a lot more heating can be done with exhaust steam than with an equal quantity of live steam. I believe it myself but cannot prove it, and do not know just why.

(See pps. 110-112, June issue—Ed.)

Can comparable figures be furnished? Probably purchased steam is metered and if steam to engine is not metered, the quantity can be figured rather close.

The fact that returns are excessively hot, would indicate that traps are not working properly or that control is lacking.

Omaha, Neb. S. G. KNIGHT

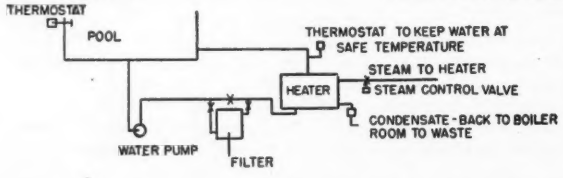
Answer No. 332

Heating and Purifying Swimming Pool Water

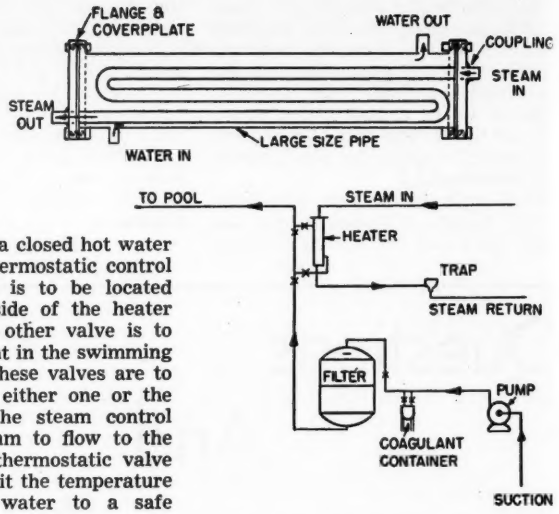
Suggestions from Wenig

THE PRACTICE of heating pool water directly—i.e. shooting live steam into the water—should be stopped. The possibility of contamination and carry over of boiler treatment chemicals, which may be harmful to the swimmers, is just an invitation to trouble.

The method used for heating and filtering swimming pools is as shown in the sketch.



Sketch by Wenig showing system for heating R. H. B.'s swimming pool water



General design by John A. Grant of heater system for R. N. B.'s swimming pool water, also details of heater

For heating, use a closed hot water heater with two thermostatic control valves. One valve is to be located on the discharge side of the heater (water line). The other valve is to be located at a point in the swimming pool water. Both these valves are to be tied in so that either one or the other may open the steam control valve allowing steam to flow to the heater. The first thermostatic valve is to be used to limit the temperature of the discharge water to a safe value.

For filtering, this will depend to a certain extent upon local or state health department regulations pertaining to the condition of swimming pool water. Try overhauling your old filter if possible; if this can't be done, I suggest you purchase a new one.

The water treated should be tested for its pH value. Usually swimming water is kept slightly alkaline. If a bacterial problem arises or is present, you would do well to investigate the possibility of using chlorine to treat the water. If you do this, the water must be tested daily for concentration of chlorine.

Brooklyn 7, N. Y. ARTHUR J. WENIG

Suggestions from Grant

SEVERAL YEARS ago I constructed a heater for a medium size swimming pool similar to the drawing herewith. The heater did a very fine job at a very moderate construction cost.

It is rather difficult to give specifications in regard to construction, not knowing details about your plant, but figuring your pump discharge in gallons, steam pressure of your system will let you get a good idea about the coil size to use.

Our heater was connected in the filter discharge line and a by-pass placed around the heater for summer operation. It is a rather poor idea to place a heater between the pump and your filter because the warm water is rather hard on some beds and does increase the bacterial content of the water.

You should by all means overhaul your filter and put it into operation, as this is one of the most important parts of your system. This filter will remove quite a lot of matter your disinfection system will not get.

The drawing should give you a general idea for construction but if you desire more information write me.

Danville, Ill. JOHN A. GRANT

Suggestions from Graber

FIRST ON the water problem, data are not given on the number of gallons to the filter or the kind of filters you have. Perhaps the filter sand is worn out or you have blown holes through your sand bed, or you don't keep your pH and alkalinity readings in order. Or perhaps you do not back wash properly, or perhaps you do not treat the water with a set poundage of chlorine. Perhaps the piping hookup is wrong or you aren't using the right kind of sand.

Second on heating the pool. I heat our indoor swimming pool of 158,000 gal water from about 38 to 78 F in about 24 hr with an instantaneous heater, operating on about 50 psi steam pressure. This heater is set directly into a 6-in. line from the filters to the pool supply line, with no direct steam in the pool's water. It is controlled with a temperature regulator for constant temperature of 78 F, with room temperature set at 80 F. That is about all I can suggest in writing, seeing the operating is different. If there is any other information you would like to write about, I would gladly give you any help I can.

Phoenixville, Pa. ANDREW G. GRABER

Answer No. 334

First He Wants the Steam Dry, Then He Wants It Wet—from Same Boiler

STEAM at 80 psi is generated by a Scotch Marine boiler for a cleaning and dyeing plant. It is supplied to drying tumblers, hot head presses and drying rooms and gives good results. But it is not wet enough to produce proper results when used in wool and silk presses and finishing machines.

It was suggested that a reducing

valve be installed to reduce the pressure to 55 psi for the latter machines but then an engineer pointed out that this would not produce moister steam but quite the contrary.

In asking what to do to get both dry and moist steam from the same boiler, J. E. Y. pointed out that they used to have a return system on the presses and wondered if this system didn't work right and thus allowed moisture to accumulate in the presses, thus producing the pressing results desired. He also asked if the length of the steam header leading to the presses had anything to do with it.

Suggestions from Heidecker

IN ANSWERING J. E. Y.'s queries about steam used in his cleaning plant, he could have helped us a lot if he had given us the temperature and moisture content required to press silks, linens, rayons, woolens and cottons. From the information given, we may assume that the boiler is generating steam containing about 1½ per cent moisture. To increase this figure, we would suggest that the water level in the boiler be carried several inches higher and the pressure a little above 80 psig.

In the cleaning plant visited by J. E. Y., steam was generated at 125 psig. This was done to maintain high temperature and keep the steam wet. To get dry steam all they would have to do would be to install a pressure-reducing valve.

	Temperature	Pressure	Heat Content	Moisture Content
Steam leaving boiler	353 F	125	1180 Btu	1.5%
Steam to presses	353 F	125	1180 Btu	1.5%
Steam to dryers through reducing valve	303 F	55	1180 Btu	0%

J. E. Y. wants both wet and dry steam from the same boiler. An example of how this can be accomplished is shown in this table:

In an actual installation, allowances would have to be made for heat energy to drive the steam through the pipes, and for radiation of heat to the air around the piping.

Chicago, Ill. WALTER HEIDECKER

Graber Too Suggests a Desuperheater

I NOTE THAT you carry 80 lb steam pressure on your tumblers and hot head presses which you say gives you good dry steam. On your wool and silk presses and finishing machines the steam is too dry, and I feel you are right about this. I hooked up presses, ironers and tumblers with steam pressure at 100-110 psi but on the steam line to the wool and silk presses I installed a desuperheater to put moisture into the steam for a better finish.

Phoenixville, Pa. ANDREW G. GRABER

Parks Recommends a Desuperheater

FOR VARIOUS types of process work, where both wet and dry steam is required from the same source of steam, an apparatus known as a desuperheater is used. It is used to control the moisture content in the steam to any desired quantity for different types of work.

A desuperheater is a cylindrical vessel made of iron or steel and is inserted into the steam line like a valve or any other fitting. A pump supplies water at a pressure higher than the steam pressure, which enters the desuperheater through a nozzle and sprays into the path of the steam, thereby dampening it.

The moisture content of the steam leaving the desuperheater is controlled by the amount of water that is fed to the nozzle. This would be determined at the point where the wet steam is used. The flow of water is adjusted to give steam of the correct quality for the work and then left there. Desuperheaters are manufactured by power plant supply manufacturers.

Using a reducing valve to lower the steam pressure will produce dryer steam than that entering it because the steam, on passing through the valve, will be slightly superheated and will be dryer than the original steam.

Baltimore 13, Md. CHAS. W. PARKS

Ray Would Use Sluggish Drainage Idea

PLANT ENGINEERS concerned with steam heated equipment usually make every effort to supply dry steam and provide proper drainage and air elimination in order that maximum temperature may be obtained. Strange as it may seem, J. E. Y.'s problem is partly, if not entirely, answerable by efforts in the opposite direction. In my opinion, he is correct in assuming that the "moist" steam was due to local conditions involving poor drainage and probably a piping layout that was not "according to Hoyle." In any case, "moist steam" should not be demanded from the boiler. Any and all conditions that tend to cause carry-over should be avoided, regardless of the type of boiler used.

It would be impractical to submit a detailed plan for this plant without knowing the general layout such as relative locations of the various pieces of equipment, piping, pipe sizes, type or types of presses, returns overhead or below units etc. It is felt J. E. Y. is not concerned with the technical points involved but is interested in a practical solution, low in cost.

The suggestions offered here may call for some experimenting before the desired results are obtained. First, I would suggest that the steam supply line to the battery of presses be taken from the bottom of the steam main ahead of the other equipment and run horizontally to or a little beyond the last press, a trap to be installed at the end of the run. Tap the supply line on the side for service to the individual presses. Do not use traps on the inlet side of the machines.

Last, but not least, drain several of the units with a single trap. Here is where a little experimenting may be necessary. Two traps may be used with ten units on each trap or perhaps five units on a single trap might prove more satisfactory. Use a check valve between each machine and the common return of each group.

Obviously the plan here is to (1) take the steam supply from that part of the system where the most moisture will be present and (2) to provide rather sluggish drainage of the press heads. The steam blown on the work is taken from the head, where moisture must be present to provide wet steam.

Junction City, Kan. CLOYD J. RAY

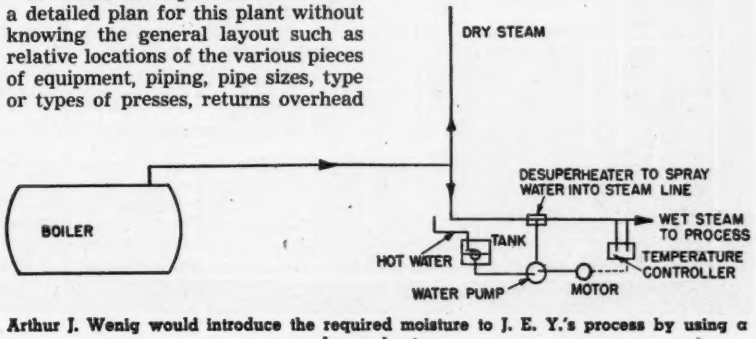
Desuperheat the Steam, Advises Wenig

IF YOUR PRESENT boiler is in good condition and is large enough to provide steam for all departments, the following will probably be your best solution:

Use a small water pump and a desuperheater. Hook it into the line which requires the wet steam (see sketch). This pump is to be controlled by a pressure-temperature control. When the temperature is too high, the pump starts adding moisture to the steam. When the steam becomes too moist, the pump stops. Pressure and temperature setting should be determined after a series of tests under actual operating conditions.

This solution will involve a minimum of new pipe work and will solve your problem satisfactorily.

Brooklyn, N. Y. ARTHUR J. WENIG



Arthur J. Wenig would introduce the required moisture to J. E. Y.'s process by using a desuperheater

Weight of Saturated Water in Lb Per Cu Ft at Various Temperatures

For explanation of the chart see page 99

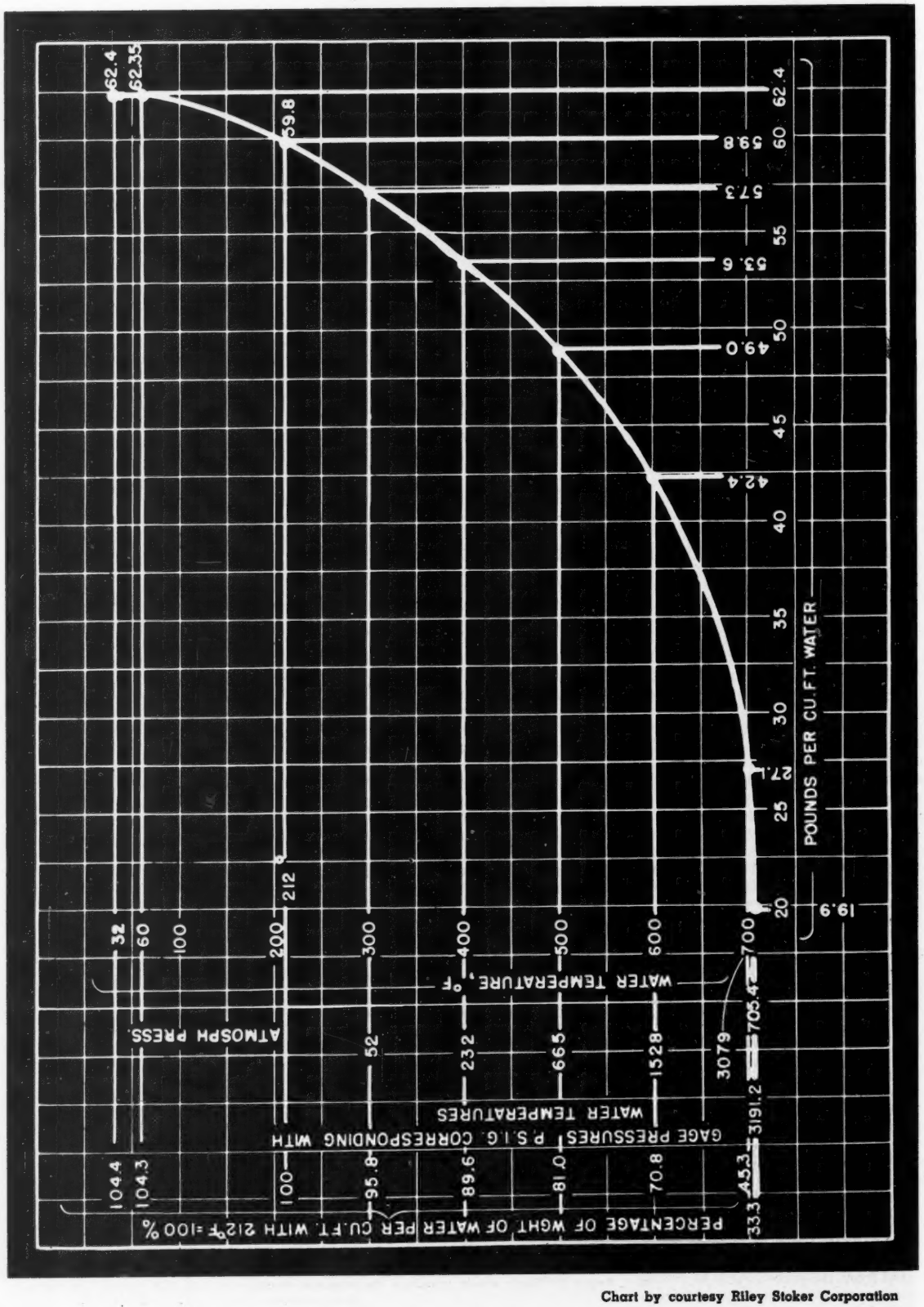


Chart by courtesy Riley Stoker Corporation

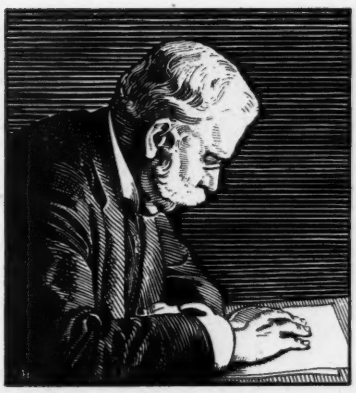
George Westinghouse Centennial Forum

VOICED OPINIONS OF WORLD FAMOUS SCIENTISTS

Reported by

Ralph E. Turner,

Editor, Power Plant Engineering



"If someday they say of me that in my work I have contributed something to the welfare and happiness of my fellow men, I shall be satisfied."— **George Westinghouse.**

During the century following the birth of George Westinghouse on October 31, 1846, science and invention has surrounded the human race with an environment of opportunities for development which far surpasses the accomplishments of any like period in the history of mankind. To this progress, Westinghouse was a noteworthy contributor whose understanding of scientific principles led to visions of science being applied to the perplexing problems of individuals, of industries, and of nations the world over, the realizations of which are being reached far beyond his span of life. That "someday" of his expressed desire is now here and the greatest of present-day scientists, engineers, educators, industrialists and humanitarians pay him honor.

IN THE SPIRIT in which Westinghouse worked for the welfare of mankind, The George Westinghouse Centennial Forum was held in Pittsburgh, Pa., on May 16, 17 and 18 when serious thought was given to the directions taken by the various branches of science and the immediate future outcome of these developments. The Forum program was conducted under the supervision of the Forum Advisory committee of which Dr. Edward U. Condon, Director, National Bureau of Standards, was chairman.

Sessions were held under the general headings of: Science and Civilization; Partners in Science; the Future of Atomic Energy; Planning in Science; Transportation—A Measure of Civilization; Horizons of Communications; Biological Science; Electric Power—the Foundation of Industrial Empire; Science and Engineering Progress—Insurance Against Aggression and Depression; the Theater of the Stars; The Micro Zoo; the Crystal Show; and a Trip Through Mellon Institute of Industrial Research.

Every one of the thirty-four speakers on the three-day program was a man of note. They included scientists, educators, industrialists — all contributors to our present day civilization. Papers presented at this Forum were recitals of accomplishments in science only so far as seemed necessary to the authors to lay foundation for thinking out and planning the courses of events to follow in advancing the benefits of science to the peoples of the world.

The theme that seemed to run through the entire program was expressed by A. W. Robertson, Chairman of the Board of the Westinghouse Electric Corp. in his address entitled, "The Golden Age of the Future." "We need in the next golden age," he said, "to learn something about ourselves so that we may make better use of the marvels which gifted men have provided for us. Man has devoted his genius wherever it has appeared to improving his environment and not himself. The confusion in our national and international thinking points definitely to the conclusion that we have no rules to guide us in the matter of human relations. As human beings, we do not know how we should behave.

"An open-minded scientific approach to the whole problem of human living without debate would undoubtedly reveal to sufficiently gifted men unsuspected rules and principles of human conduct which would lead to the correct formula for the perfect state and the perfect citizen and a society of good men. We need desperately to define the true formula for living or we all perish."

Scientific Ethics

Scientists are well aware of the dangers to the human race of the misuse of principles which they have discovered. This fact was indicated when Dr. Archibald V. Hill, Foreign Secretary, Royal Society, England, a Nobel Prize winner, in discussing scientific ethics asserted, "Scientists have provided mankind with the knowledge and tools either for his complete destruction—or for health, welfare and happiness beyond all his experiences. We have had a large part in producing a crisis in history. Let us try to supply also, by our example, a common standard of ethical behavior and of courageous insistence on frankness and collaboration so that mankind can decide, with his eyes open, which of these alternatives of destruction or well being he will choose. It would be a sad epitaph for the human race that extinction should result from scientific discoverey applied and exploited without ethical control."

Continuing this line of thought he declared that scientists have the right and duty to question and discuss the nature of their own calling and its special contribution—and danger—to national and international welfare; refuse conditions of employment or advancement, however otherwise attractive, which do not meet the ethical requirements of what could be one of the most important common interests of mankind; refuse to cooperate in tasks in which they, or their representatives, are not allowed a reasonable share or partnership in the responsibility of deciding on the purpose, or the policy, or the probable outcome of their work.

Social Aspects of Science

In considering the social composition of scientific power, Dr. Isaiah Bowman, President, Johns Hopkins University, asserted that it is necessary to examine the relation of science to international politics, declaring "We must decide what we shall do with power of every sort, including scientific power, what social composition we shall give it, in the form of the highest social good. We must all be social scientists first or, by misusing power, we may end by destroying the human spirit which is responsible in the millennia of striving for what we call civilization.

"Parliaments rather than dictators, free speech rather than 'party line,' rising standards of living to which applied science contributes powerfully, striving for peace rather than confusion supported by a simulated fear of war—these are among the building blocks of our future 'good life'."

In the Field of Biology

Preparation for defense against attack by biological warfare has led to scientific discoveries that will be of incalculable benefit to mankind, in the opinion of George M. Merck, manufacturer of penicillin and streptomycin, for in this branch of science lies the promise of the control on a

Fig. 1. Westinghouse Memorial erected in Schenley Park in 1930 with panels depicting diversified achievements of his career

world wide basis of many diseases afflicting man and beast as well as plant life.

Through wartime research, information was obtained regarding the effect of more than 1000 different chemical agents on living plants. It was stated that the scientists in charge of this work believe that eventually any living plant process may be brought under control through critical use of some growth regulating substance. What can be accomplished in plant life should be studied as a guide in further work with animal and human life. A plea was made for a generous and full measure of support for research in the biological sciences.

Gwilym A. Price, President of Westinghouse Electric Corp., was thinking in a somewhat similar vein when he said, "Instruments, techniques, theories — all developed for purposes of destruction—have given us a new wealth and a new challenge. The awesome power which we now have for destruction has given us a new, and I hope a lasting, realization of the impact of science on our affairs. In return for our new-found wealth we are forced to assume new and critical responsibilities. We must view the bewildering number of forces and agencies we now have and, with conviction and faith, shape them to good purposes."

In advocating speedier steps toward industrial application of scientific discoveries, Dr. L. W. Chubb of the Westinghouse research laboratories, pointed out that "The more rapid unfolding of the secrets of nature, the encouragements given to scientific pursuits and especially the technical accomplishments during the war, have all shown more than ever before the great influence of science on our national welfare."

Atomic Energy

Contributing to the symposium on The Future of Atomic Energy were Dr. J. Robert Oppenheimer, Professor of Physics of the University of California, Dr. Enrico Fermi, Professor or Physics of the University of Chicago, Dr. W. Edward Chamberlain, Professor of Roentgenology and Radiology of Temple University of Medicine, and Dr. Hugh S. Taylor, Dean of Graduate School of Princeton University.

Dr. Oppenheimer discussed the explosives phase of atomic energy and expressed his view that "the development of atomic weapons can make, if wisely handled, the problem of preventing war, not more hopeless, but more hopeful, than it would otherwise have been—because it provides new and healthy avenues of approach."

In the field of power, Dr. Fermi declared, "We might conceive that 20 or 30 yr from now the general scheme of atomic energy production may be perhaps about as follows: There will be large central installations in which very great amounts of power will be produced and transformed into electrical energy or steam for local power consumption. Besides producing power directly, these large units may also produce some amount of plutonium which will be extracted and distributed to small installations in which plutonium and not uranium will be used as a primary fuel. This plan would have the advantage of permitting wide use of relatively small power units thereby reducing very greatly the difficulties of distribution."

The possibilities of beneficial developments of atomic energy in the field of radiation therapy are attracting attention and in the opinion of Dr. Chamberlain improved methods of releasing and applying atomic energy will doubtless prove of real value in the treatment of such malignant growths as cancer, he cautioned, however, against over optimism. Tracer techniques which make use of radioactive isotopes from cyclotron, betatron or chain-reaction pile are permitting the study of intermediary metabolism of important elements and compounds without disturbing that metabolism through the introduction of unnatural conditions.

Tracing the development work of atomic research in the field of chemistry, Dr. Taylor described, step by step, what has taken place up to the present time and spoke enthusiastically about the value of "tracer" techniques particularly in the fields of metallurgy and metallography. "The time is at hand," he said, "when we should go back to our fundamentals of inorganic and organic chemistry to ascertain whether, with the newer reagents, now available on large technical scale, we can devise new approaches to old objectives."

Planning in Science

In his Centennial address under the title, "Planning in Sciene," Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, and President of Carnegie Institute, expressed his opinion that the balance of power among the five great world powers must be redressed for the good of the world and for the development of peace and plenty under the leadership of the United Nations. Pointing out that the United States had already made some commitments to its international colleagues and that others must be made, he continued, "Our national planning must back them up. Our planning must be for a strong United States, strong industrially, economically, socially and during the interim years, militarily. Whatever the methods we adopt for solution of the many problems to be encountered in the peacetime years, it is essential that we maintain throughout the nation the solidarity which was one of our greatest sources of strength during the wartime period."

The contributions of science to our daily lives, he indicated, is in a fair way to becoming more and more a direct intellectual contribution. "These intellectual contributions, I believe, will consist primarily in an attitude toward factual data, in the effort at sharp and specific definition, in the endeavor, whatever the issue under consideration, to clear out extraneous side issues and focus attention and effort on the nub of the problem."

Transportation

Getting down to the more specific problems of the day, the symposium on "Transportation—a Measurement of Civilization," conducted under the chairmanship of Robert P. Russell, President of the Standard Oil Development Co., was fruitful of ideas that can be worked upon in the immediate future. Contributing to this symposium were Dr. Edward Warner, President of Interim Council, Provisional International Civil Aviation Organization; Vice Admiral Emory

S. Land, U. S. Navy (Retired); Martin W. Clement, President of the Pennsylvania Railroad; Harland Bartholomew, of Harland Bartholomew and Associates; and Dr. Charles F. Kettering, Vice President and Director of General Motors Corporation.

Dr. Warner stated that in line with the plan proposed by the meteorological experts for making observations both at the ocean's surface and in the upper air, other aids to air navigation and air traffic will absorb the major share of aeronautical research within the next few years. It was his thought that the greatest advance that can be made in air transport from the present level is not in speed, or even in economy, important as that is, but in regularity. He also gave support to the adoption of a general code defining the privileges, to which all states are entitled, in international airline operation and the conditions under which those privileges may be exercised. He stated that efforts are being made to render greater service and less annoyance to travelers, particularly through foreign countries. The gas turbine is looked upon as having great possibilities.

Admiral Land estimates that this country will have a 15 to 20 million ton peacetime merchant marine which should carry about 50 per cent of our exports and imports.

Mr. Clement contended that self-imposed discipline, as opposed to governmental discipline, is a basic requirement without which the nation cannot hope to advance despite long strides forward in science and industry. "A mob adrift is a dangerous thing," he said, "but a mob is only adrift because of the type of leadership to which it is responsive — whether it be political or social or otherwise."

In declaring that bold and effective planning is the outstanding need of American cities today, Mr. Bartholomew called attention to the fact that "In transportation, as in many other forms of scientific advancement, technology has proceeded faster than our ability to apply it wisely to the need and uses of population in our urban areas." He also indicated that air transportation poses new problems in urban areas which will become more complicated with future development of the autogyro or helicopter.

Microscopic Life

Developments in the biological science were discussed in a symposium under the chairmanship of Dr. Hugh S. Taylor, Dean of Graduate School of Princeton University. The extremely interesting yet highly technical papers presented at this session carried the thinking of the audience far afield from the power industry which may be observed from this list of papers: Light and Life—Photosynthesis, by Dr. Cornelis B. van Niel; High-Frequency Radiation and the Gene, by Dr. George W. Beadle; The Microbe—Friend and Enemy of Man, by Dr. Selma A. Waksman; and Molecular Architecture and Biological Reaction, by Dr. Linus Pauling. Suffice it to say here of this symposium that it dealt with the wee small organisms of nature, the microscopic and submicroscopic forms of life, medicines, particularly those most recently discovered, the fight against pestilence and epidemics, facts learned about old and new diseases, chemotherapy, radiotherapy, hereditory aptitudes and many other phases of the biological science.

Alternating Current Pioneered by Westinghouse

Strictly in the power field was the paper by Charles W. Kellogg, President of the Edison Electric Institute, whose address entitled, "Electric Power—the Foundation of Industrial Empire," traced the development of the electric utility industry from its beginning, emphasizing particularly the many contributions to the technological development of the industry made by George Westinghouse and his associates in companies he organized for the promotion and application of engineering ideas and discoveries. Probably the most important work done by Westinghouse was his pioneering in the commercial application of alternating current electricity of which Mr. Kellogg said, "The use of alternating current transmission system is one of the foundations on which our national economy is based. It makes possible the widespread use of electric power in industry and in the home and has aided immeasurably in the development of the high standard of living enjoyed by Americans."

"In commemorating the life of George Westinghouse, which began one hundred years ago," said Mr. Kellogg, "we express amazement at what he accomplished and deep gratitude for his great contribution to our common life; and we draw high inspiration from the qualities of mind and heat of this great American."

Scientific Personnel

"Both for security against aggression and security against depression there is no element which is more important than to have the most adequate possible complement of able, well-trained scientific personnel in our country," declared Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, in his address on "Scientific and Engineering Progress—Insurance Against Aggression and Depression." This is more important in the last analysis that laboratories or factories "because without scientists of the highest caliber, laboratories will only be a delusion and a waste of money, and factories will before long become obsolete." Dr. Compton expressed himself as strongly favoring legislation by Congress which would set up a commission for the control of atomic energy.

Impressions left by attending the forum were that practical application of newly found principles of science had greatly speeded up during the war years, that fundamental research had been set back by the wartime activities, that sociological advancement is the greatest need of the day, that atomic energy is in the embryonic stage of its development as an industry, that biological science has recently acquired new tools with which to diagnose and cure diseases, and that with proper planning in all the sciences peoples of the world will soon enter a civilization free of many of the ills of the present day.

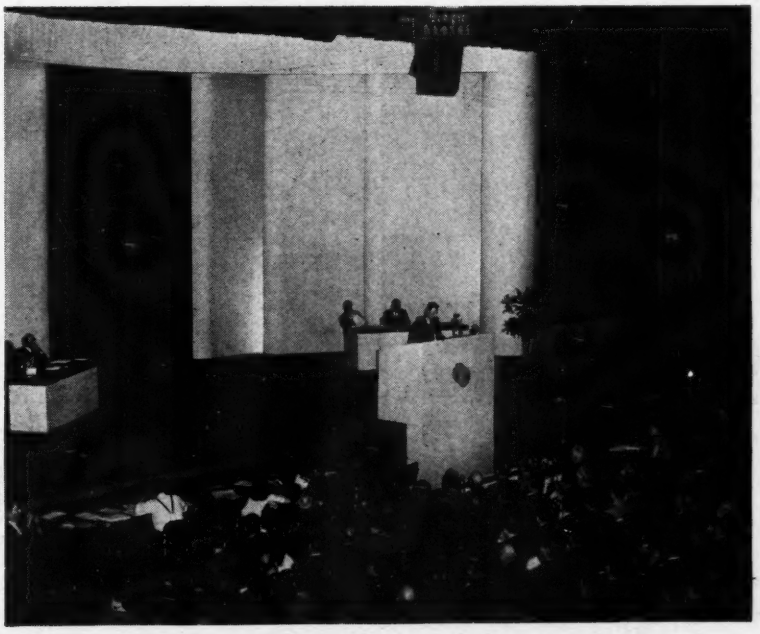
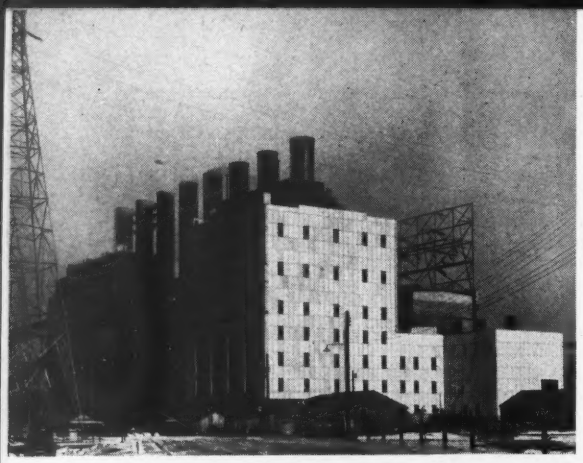


Fig. 2. Dr. J. Robert Oppenheimer addressing Forum on "The Future of Atomic Energy"



SPRINGDALE

New unit No. 7 at Springdale Power Station of West Penn Power Co. on Allegheny River 18 miles above Pittsburgh, Pa. . . . Consists of an 80,000-kw, 3600-rpm, condensing turbine generator to which steam is supplied at 1250 psi, 925 F by an 800,000-lb-per-hr pulverized-coal-fired radiant-type steam generating unit . . . Plant receives coal direct from mine across river . . . New unit essentially independent of rest of station. Increases net station capacity to about 320,000 kw . . . Preliminary tests indicate heat rate 10,850 Btu per kilowatt-hour net and overall boiler efficiency 90 per cent

Fig. 1. Exterior view of Springdale Power Station. In foreground, addition housing new 80,000-kw unit No. 7

THE 80,000 kw addition to the Springdale Power Station was begun during war days. W. P. B. approval was received June 19, 1944, and construction was started June 21, 1944. In spite of set-backs due to manpower and material shortages, construction proceeded steadily until December 30, 1945, when the unit first went on the line. Engineering and construction of the plant was performed by Sanderson & Porter of New York City in collaboration with West Penn Power Co.'s engineers.

The new addition, a completely independent unit, consists of an 80,000-kw condensing turbine-generator, and an 800,000-lb-per-hr, 1325-psi, 925 F radiant type boiler with their auxiliaries. It delivers electric power at 132 kv to the transmission lines.

The station already included 240,000 kw in five 1800-rpm machines and one 50,000-kw superposed high-pressure 3600-rpm unit. The new unit, No. 7, thus raises the capacity of the station to 320,000 kw net.

This article gives a general description of the outstanding features of this new addition. A complete list of the mechanical equipment will be found on page 114. Design and operating details of boiler, turbine, and generator and their auxiliaries, together with a list of electrical equipment, will be given in futures issues.

Boiler and Related Equipment

The single boiler is of the radiant type designed for a continuous output of 800,000 lbs. of steam per hour with steam conditions of 1325 psi and 925 F at the superheater outlet with 430 F feedwater. Features of the boiler include the largest furnace ever built, low heat release and low gas velocity. The entire boiler below the air heater is suspended from the building steel which allows free expansion in any direction. The boiler expands downward about 3 in. when starting up.

The furnace is divided into two sections by a vertical, radiant screen with open sections to equalize furnace conditions. The boiler and furnace contain 23,253 sq ft of heating surface with an effective furnace volume of 60,200 cu ft. Approximate heat release at full load is 15,400 Btu per cu ft per hour. Figure 2 shows the general arrangement of the boiler and its auxiliaries.

Steam temperature is controlled by a spray type attemperator located between and in series with the two sections of the superheater. Automatic control maintains steam temperature by regulation of the amount of condensate water fed to the attemperator nozzles.

The boiler is cleaned with an automatic sequentially-operated system of pneumatically-operated retractable blower units and pneumatically-operated rotor units. Blowing medium is steam at 325 psig and 700 F.

Turbine and Related Equipment

The turbine has a normal rating of

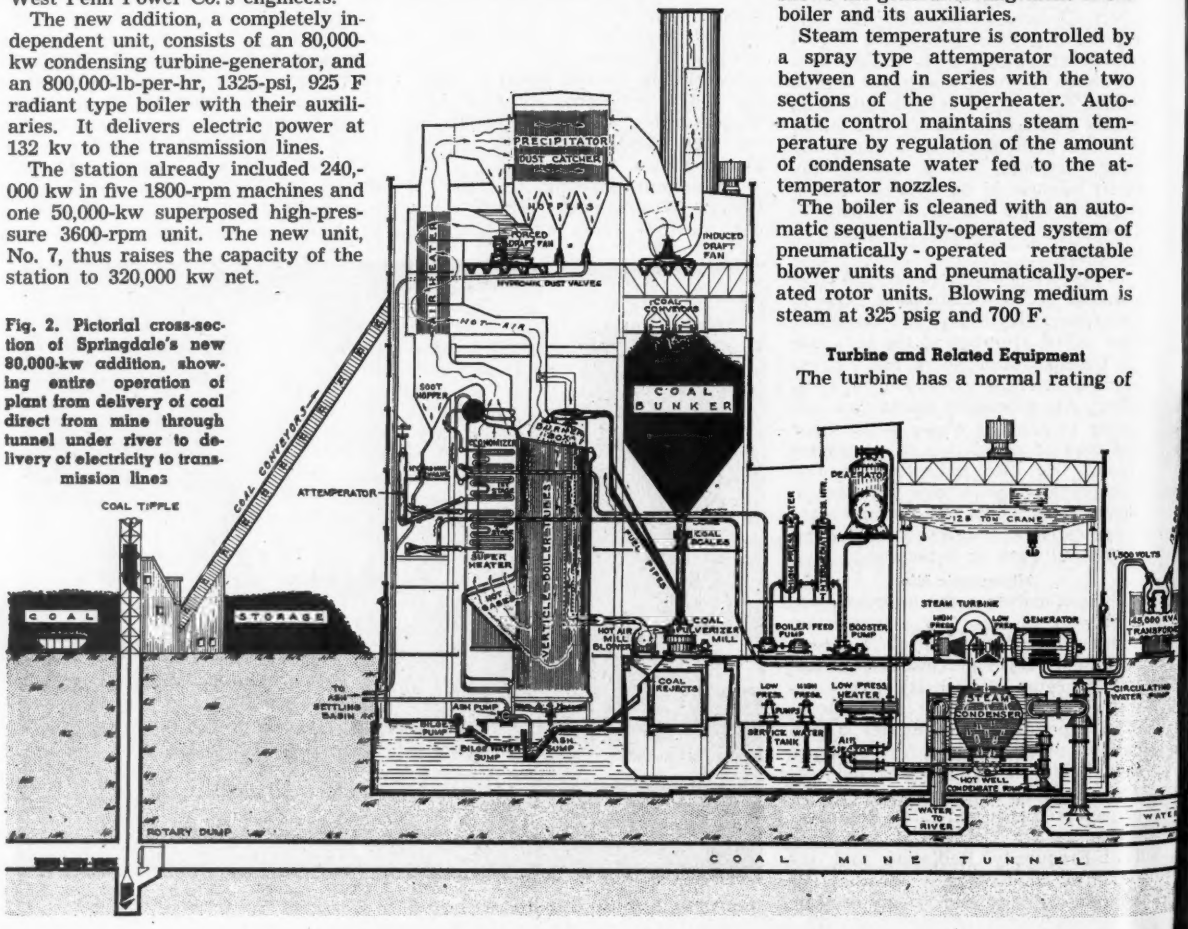


Fig. 2. Pictorial cross-section of Springdale's new 80,000-kw addition, showing entire operation of plant from delivery of coal direct from mine through tunnel under river to delivery of electricity to transmission lines

Adds 80,000-kw Unit . . . . .

65,000 kw and full load rating of 81,250 kw at 1250 psig, 925 F and 1.5 in. Hg absolute. It is a two-cylinder, tandem-compound, double-flow impulse reaction type unit, operating at 3600 rpm. Turbine can withstand certain brief temperature swings of 15 min or less duration up to 950 to 975 F aggregating not more than 1 per cent of the operating time. There are four extraction points for feed water heating. Further data and illustrations of turbine details and the heat balance will be given in a future issue.

Steam exhausted from the turbine flows to the 50,000 sq ft condenser of the single-pass, radial-flow type, with divided cast-iron water boxes. The condenser is spring supported and is bolted directly to the turbine exhaust nozzle without the use of an expansion joint.

Feedwater Heating

Four-stage regenerative feedwater heating is used. The deaerator was placed at a high elevation to prevent the likelihood of pump failure due to flashing or cavitation.

Three high-pressure boiler feed pumps, each have a capacity of 500,000 lb of water per hour with a total dynamic head of 1400 psig with water temperature at 430 F. These pumps can be operated without recirculation when throttled on the discharge by-pass to 50,000 lb per hour.

Make-up is furnished by an evaporator rated at 17,800 lb of vapor per hour at 35 psig. At normal rating the evaporator delivers vapor with less than one part per million solids with a brine concentration of 2500 ppm. Water supply for the evaporator comes from two zeolite water softening units with the zeo-dur type of zeolite.

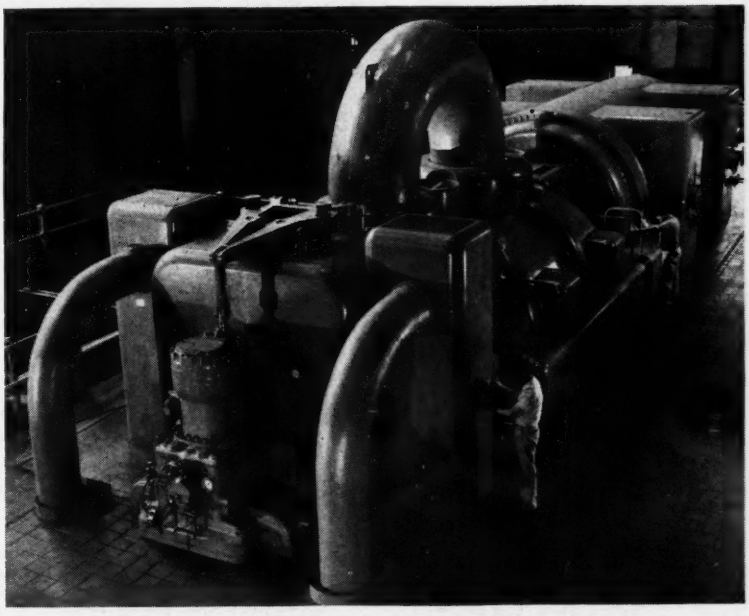


Fig. 3. General view of new No. 7 turbine generator unit. Normal rating 65,000 kw; full-load rating 81,250 kw on 1250-psi 925-F steam; 3600 rpm

Electric Generator and Connections

The new No. 7 Unit generator is an 81,250-kva, 80 per cent pf 60-cycle, 3600-rpm, 11,500-v hydrogen-cooled, generator with step-up transformers and all necessary auxiliaries. This is almost an isolated unit electrically, with no paralleling of circuits under normal operation other than at 132 kv. A few of the auxiliaries are supplied from the existing station.

The generator is capable of delivering 115 per cent of rated kva at 0.8 pf when operating in hydrogen at 15 psig pressure. In the neutral of the generator there are installed current transformers for metering, relaying and voltage regulator with space provided for compensators for use with an electronic exciter. (A complete description of this exciter was given in POWER PLANT ENGINEERING, April, 1946, page 68.)

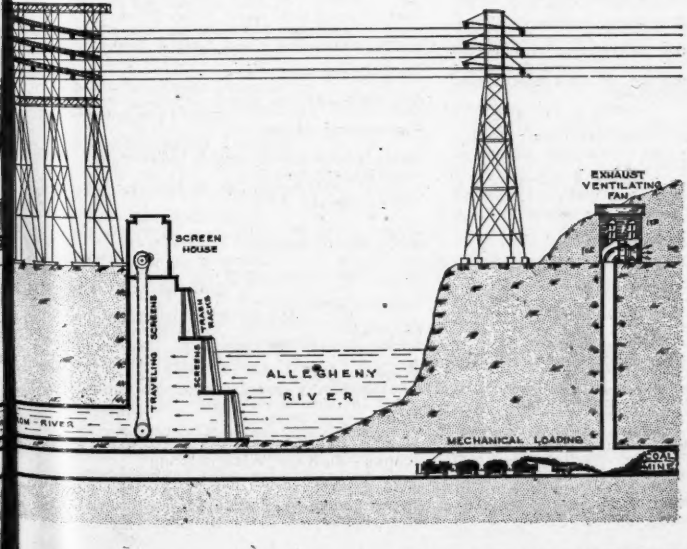
Twelve 2,000,000-cm section, 12 kv, cables were used instead of bus work to provide a continuous copper connection from the generator terminals to the oil circuit breakers and transformers.

Transformers

The two 45,000-kva 3-phase transformers are located within 240 ft of the generator and approximately 100 ft apart, providing good segregation, eliminating the use of fire barriers and permitting direct connection of the high tension sides to their respective sections of the 132-kv bus.

Adjacent to each transformer is mounted a 3000-amp, 1,500,000-kva 15-kv electrically-operated oil circuit breaker equipped with 34.5-kv bushings, identical with those installed on the low tension side of the transformer. These breakers are used to switch the generator onto the system and provide for overall automatic clearing of faults for each of the transformer banks.

The energizing and de-energizing of the high-tension side of each transformer by a motor-operated airbreak switch has proved surprisingly successful.



Mechanical Equipment, Springdale Power Station, New 80,000 kw Unit

West Penn Power Co., Pittsburgh, Pa.,

BOILER EQUIPMENT

Boiler Babcock & Wilcox Co. Radiant type—design pressure 1550 psi—continuous rating 800,000 lb per hr with 1325 psi at sup. outlet and 925 F temp., with feedwater temp. 430 F. Boiler entirely suspended from top.

Air Preheater Babcock & Wilcox Co. 108,000 sq ft—vertical, welded element tubular type.

Fly-Ash Precipitator Research Corp. Cottrell Electrostatic type.

Ash Disposal—Fly Ash—Hydro-Mix Valves Allen-Sherman-Hoff Co.

Ash Handling System Allen-Sherman-Hoff Co. Two feed chambers, ash sump and bilge sump. Also sluicing system for pyrites transportation system from mills to ash sump.

Attemperator—Spray-Type Babcock & Wilcox Co. 6 Thermal type spray nozzles, each with Bailey control valve. Maintains average of 925 F ± 10 F at sup. outlet between 400,000 and 800,000 lb of steam per hr.

Economizer Babcock & Wilcox Co. 18,800 sq ft—continuous-tube type steel economizer—design pressure 1650 psig.

Fans—Forced Draft B. F. Sturtevant Co. 2 — 132,000 cfm maximum capacity, air temperature 135 F; 13 in. static pressure at 1175 rpm. Turbovane No. 115—Design 9—Double width—Double inlet.

Fans—Induced Draft B. F. Sturtevant Co. 2—230,000 cfm max capacity with flue gas at 425 F. Develop 10.9 in. static pressure at 695 rpm. Turbovane No. 1010 Type ID—Double width—Double inlet.

Coal Feeders Babcock & Wilcox Co.

Flues and Stack Connery Construction Co.

Hoppers—Coal Screening Stock Engineering Co.

Burners—Pulverized Coal Babcock & Wilcox Co.

Soot Blower System Vulcan Soot Blower Corp.

Coal Pulverizer Mills Babcock & Wilcox Co. 5—Type E, Size E56—Class 111BA. The pressure on the grinding elements can be adjusted while the pulverizer mill is in operation.

Superheater—No. 77 Boiler Babcock & Wilcox Co. 34660 sq ft — continuous self-draining type. Des. press. 1550 psig. Op. press. outlet, 1325 psig. Total temp. at op. press. 925 F.

Coal Scales (6) Stock Engineering Co.

TURBINE EQUIPMENT

Turbine—No. 7 Main Unit Westinghouse Electric Corp. Normal rating 65,000 kw, full load rating 81,250 kw, 3600 rpm—Two-cylinder tandem-compound, double-flow-impulse reaction type—Steam pressure 1250 psig, steam temperature 925 F. Vacuum 28.5 in. Hg—Turbine can withstand brief pressure swings to 1440 psig, and temperature swings to 15 min or less duration up to 950-975 F. aggregating not more than 1% of operating time. Four extraction points.

Condenser Westinghouse Electric Corp. 50,000 sq ft effective surface; single-pass, radial-flow type; divided cast-iron water boxes.

Air Ejector Westinghouse Electric Corp.

Cooler—Hydrogen Westinghouse Electric Corp.

FEEDWATER CONDITIONING

Deaerator Elliott Co. 1,000,000 lb per hr; water storage tank 2200 cu ft capacity at normal operating level. Design pressure 50 psig. Oxygen content of effluent not over 0.007 ppm.

Deaerator—for Evaporator Feedwater Supply Elliott Co.

Evaporator Griscom-Russell Co. 17,800 lb vapor per hour at 35 psig from feedwater at 250.3 F when 18,080 lb per hr of steam is condensed in the tubes at 122 psig and 460 F. No. 103-A-192 G. R. Bentube Horizontal Evaporator Type J-2 Style F.G-R. At normal rating, evaporator delivers vapor with less than one ppm solids with a brine concentration of 2500 ppm.

Steam Purifier—Main Vapor Line From Evaporator Cochrane Corp.

Heater—Extraction—High Pressure Alco Products Div., American Locomotive Co. 3200 sq ft eff. heating surface—Size 42-188 Type C6-44-32-V vertical heater, floating-head, pull-through, removable-bundle type 1100. Working pressure, shell 400 psig, tubes 550 psig. Max. temp. shell 675 F, tubes 450 F. Heat exchanged 67,374,000 Btu per hr. Transfer rate 725 MTD (corrected) 29.

Heater—Extraction—Intermediate Pressure Alco Products Div., American Locomotive Co. 2380 sq ft eff. heating surface—Size 39-172 Type C6-44-32-V vertical heater, floating-head, pull-through, removable-bundle type. Working press. shell 200 psig, tubes 550 psig. Max. temp. shell 500 F, tubes 400 F. Heat exchanged 52,796,000 Btu per hour. Transfer rate 870 MTD (corrected) 25.

Heater—Extraction—Low Pressure Alco Products Div., American Locomotive Co. 2970 sq ft eff. heating surface—Size 42-189, Type C6-44-32H horizontal heater, floating-head, pull-through, removable-bundle type. Working press. shell 150 psig tubes 250 psig. Working temp. shell 250 F, tubes 225 F. Heat exchanged 58,450,000 Btu per hr. Transfer rate 600 MTD (corrected) 32.8. No. passes: shell side 1; tube side 4.

Softening Units—Water The Permutit Co. 2—Zeolite water softening units, 7'0" OD x 1'9"; high-strength shell. Cap. 90,000 gal of water per 6-hr period between regenerations. Capacity of unit between regenerations 630 kilograins. Straight shell to allow future increase in capacity to 846 kilograins. Flow 192 gpm normal to 230 gpm maximum; 3" multiport type valves. Full automatic control equipment. Type of Zeolite: Zeo.-Dur. Working press. of shell 100 psig.

CONTROLS AND INSTRUMENTS

Combustion Control Hagan Corp. Regulates primary air flow to all mills to control mill output. Operates from measurement of steam pressure at turbine inlet. Coal-air temperature at individual mills regulated from measurement of mill outlet temperature. Furnace draft maintained constant by regulation of induced draft fan inlet vanes, while forced draft inlet vanes controlled by differential Master system to maintain proper fuel-air ratio. All controls pneumatically-operated; centralized at operating panel.

Feedwater Drain Control Hagan Corp. For high, intermediate and low heater drainage; pneumatic level transmitters controlling spring-loaded, diaphragm-actuated flow control valves.

Feedwater Heaters Water Level Hagan Corp.

Feedwater Pump By-Pass Control Bailey Meter Co.

Control—Hotwell Level Hagan Corp.

Controls—Mill Level Bailey Meter Co.

Superheat Control Bailey Meter Co. Cascade three-element attemperator type, controlling steam temperature, paralleling attemperator water flow to combustion air flow and readjusting from steam temperature.

Three-element Feedwater Control Bailey Meter Co.

Circulating Water Differential Transmitter Hagan Corp. To check cleanliness of condenser tubes.

Conductivity Recorders Leeds & Northrup Co.

Multipointer Gages Bailey Meter Co.

Steam Flow, Air Flow Meter and Various Flow Meters Bailey Meter Co.

Temperature Indicators Leeds & Northrup Co.

Temperature Recorders Bailey Meter Co.

Water Level Recorders Bailey Meter Co.

PUMPS

Ash Pump Allen-Sherman-Hoff Co. Size 6" x 6"—5" Wide C Frame—Type C—Horizontal Hydroseal abrasion—resistant alloy ash pump. Capacity 1175 gpm of material laden solution through 6" discharge line 1200 ft long.

Ash Pit—Water Supply Pumps Byron Jackson Co.

Bearing Water Auxiliary Pump Ingersoll-Rand Co.

Boiler Feed—High Pressure Pumps Byron Jackson Co. 3—6" x 12½"—7 Stage—Type HBD, cap. 500,000 lb water per hr at 3585 rpm, suction press. 440 psig, disch. press. 1840 psig; equivalent to total dynamic head of 1400 psig, with water temperature of 430 F. Efficiency 69%. Power required 1415 bhp.

Boiler Fill Pumps Byron Jackson Co.

Booster Pumps—Feedwater System Allis-Chalmers Mfg. Co. 3—1080 GPM—Size 8" x 6"—Type MI-4. Double-suction, 4-stage, cap. 1080 gpm against 1000 ft total dynamic head—NPSLH 15 ft—Water temperature 287 F. Efficiency 70%—Suct. press. 50 psig. Disch. press. 450 psig.

Booster Pump—Softened Water Ingersoll-Rand Co.

Brine Pumps—Zeolite Water Softening Plant Deming Co.

Circulating Pumps—Main Condenser Westinghouse Electric Corp. 2—48" dia., discharge vertical, single inlet, bottom-suction, propeller type. With two pumps in parallel, cap. each pump 48,750 gpm at 495 rpm against a total dynamic head 18 ft. With only one pump, capacity is 61,000 gpm.

Condensate Pumps Westinghouse Electric Corp. 2—Size 6" x 12"—Type 63EN—3 stage—vertical centrifugal cap. 1400 gpm, 1170 rpm, total dynamic head of 300 ft. Efficiency 64.5%—164.5 hp.

Deaerator Feed Pump—Auxiliary Ingersoll-Rand Co.

Evaporator Feed Pumps Ingersoll-Rand Co. 2—Size 2" x 3"—Cameron No. 2—Class GT—two stage, single suction, horizontal

Fire Pumps Buffalo Pumps, Inc. 2—1000 gpm Class "SU" Underwriters fire pump without underwriter fittings. Single stage. Cap. 100 gpm, 1775 rpm, total press. 125 psig.

Flood Pumps Byron Jackson Co. No. 5 EH special deep well turbine type.

Fuel Oil Pumps—Boiler Starting The Viking Pump Co.

Gland Seal Water Pumps—H.P. Boiler Feed Pumps Byron Jackson Co.

Oil Filter Pump Worthington Pump & Machinery Corp.

Recirculating Pump—Economizer The Hankison Co.

Service Water Pumps—High Level Byron-Jackson Co.

Service Water—Intake Pumps Byron Jackson Co.

Sump Pump—Ash Pit Allen-Sherman-Hoff Co.

Sump Pumps—Ash Settling Basin Goulds Pump, Inc.

Sump Pump—Boiler Room Yeomans Brothers Co.

Sump Pump—Brine Pump Room Zeolite Water Softening Plant Deming Co.

Sump Pumps—Turbine Room Yeomans Brothers Co.

Sweet Water Pumps Ingersoll-Rand Co.

OTHER EQUIPMENT

Ash Water Standpipe Connery Construction Co.

Low Level Service Water Standpipe Connery Construction Co.

Structural Steel Bethlehem Steel Co.

Bearing Water Tank— Connery Construction Co.

Chemical Feed Tank—(600 psig 300 F.) Pittsburgh Piping & Equipment Co.

Flash Tank—Continuous Blow Down Pittsburgh Piping & Equipment Co.

Gland Water Drain and Supply Tanks Connery Construction Co.

Roof—Condensate Tank Connery Construction Co.

Salt Tank—Zeolite Water Softening Plant The Permutit Co.

Sweet Water Tank Connery Construction Co.

Sweet Water Tanks (Boiler Drain Tank) No. 72 and No. 73 Pittsburgh-Des Moines Steel Co.

Tile—Unglazed Facing Stone Creek Brick Co.

Valves—High Pressure Walworth Co.

Valves—Low Pressure Reading, Pratt & Cady.

Wall—Temporary South 1¼" Transitop Johns-Manville Co.

Grating—Steel Reliance Steel Products Co.

Insulation Johns-Manville Co.

Louvres and Ventilators H. H. Robertson Co.

Mulsifyre System Grinnell Co. Automatically operated for fire protection in turbine oil room.

Piping—High Pressure Pittsburgh Piping & Equipment Co.

Roof—Precast Concrete Lastik Products Co.

Roofing—Built-Up Waterproofing Limbach Co.

Sash—Steel Truscon Steel Co.

Brick—Facing Standard Clay Products

Brick—Glass Pittsburgh Plate Glass Co.

ATOMICS

A New Section added to POWER PLANT ENGINEERING to cover current and forthcoming developments in atomic energy and related developments and applications in Nuclear Physics

ON THE WAY TO BIKINI

By ANDREW W. KRAMER*

Managing Editor, Power Plant Engineering

Just as this issue was going to press, this report came direct from our correspondent on the U. S. S. Appalachian. It was apparently written just before the ship reached Honolulu, where a two-day stop was scheduled. By the time you read this, the first test may have been made and some of the results reported in the newspapers. This report gives details of the ship, which has been assigned and equipped especially for communications in connection with these atomic bomb tests. Comments are given on the correspondents, their activities during the voyage, preliminaries of the tests, safety procedures, data on Bikini Atoll and the reactions of the correspondents to the recent proposals for atomic energy control made by Mr. Baruch before the United Nations Atomic Energy Commission. Following this report is an analysis of the reasons for the tests, and the techniques to be used in obtaining data from them

Aboard the *U.S.S. Appalachian,*
June, 1946.

IT SEEMS much longer than only a little over a week ago since I left the editorial rooms of POWER PLANT ENGINEERING to accompany JTF-1 on Operation Crossroads; so very much has been crowded into a short space of time. To begin with there was the journey to San Francisco, the excitement of embarkation—getting information regarding the procedure of boarding ship, how to get to the ship, etc. Every possible aid was afforded us. A Crossroads car pool under the direction of Captain Berry's office in San Francisco was available to carry the press representatives to the ship. Shortly after my arrival in Oakland, a station wagon called for me at my hotel and in a short time we were driven to the great Naval Supply Base where the *Appalachian* was docked.

One look at her confirmed my expectations; she was a fine ship. She was the first of a new class of Amphibious Force Flagships (AGC's), completed during the war. Her presence in the Fleet as well as the presence of her sister ships was kept a closely guarded secret. Every effort was made to keep her function known only to those who needed to know. She is 459 ft in length, has a beam of 64 ft and a full load displacement of approximately 12,500 tons.

She is powered by a General Electric 6000-hp, cross-compound steam turbine driving a single screw through a gear. Steam for this turbine is generated at 450 psi, 750 F by two Combustion Engineering Co. oil-fired water-tube boilers. With an average speed of 15 knots, she is not a fast ship but she is a very economical one. At 15 knots, the fuel consumption is only 550 gal of oil per hour. At the speed of 13½ knots that we are making now, we are using only 350 gal per hour. The ship is equipped with four 300-kw d-c v electric generators and a number of motor generators to supply a-c.

A feature of particular interest is the tremendous amount of communication and radar equipment with which she is equipped. If a Hollywood producer had set out to design a setting for a Buck Rogers film, he could never have devised such a fantastic and weird array of antenna, radiators, revolving dipoles, screens and gadgets as one sees mounted on the steel structures and masts of this vessel. Even her stack is surrounded by an array of vertical radiators and reflectors.

For her present assignment, that of press ship for Operation Crossroads, the *Appalachian* was specially equipped with multiple radio-teletypewriter circuits, radio-telephoto service, radio broadcasting circuits to the principal radio networks, and television equipment. Every possible effort has been made to provide fast and ample transmission of atomic bomb test news to those of you back home. The communication equipment is capable of transmitting a minimum of 200,000 words daily to the west coast.

Press Representatives

We left San Francisco with about 110 press representatives aboard. These men represent a cross section of the entire American news service, the newspapers, the general magazines, the radio broadcasting services, the wire services, the television interests and the technical press. We expect to pick up about 10 more members at Honolulu when we arrive there on June 18. Among our passenger list there are many names of importance—noted newspaper men and men prominent in radio broadcasting. Norman Cousins of *The Saturday Review of Literature,* Bill Downs of CBS, David Dietz of Scripps-Howard, William Lawrence of the *New York Times* are representative names.

*Accredited Press Representative to witness Operation Crossroads at Bikini Atoll.

ATOMICS

With such a small overall group, naturally the number of representatives of the technical press is small. Among the technical editors, besides myself, are Philip W. Swain, representing The McGraw-Hill Publishing Co., Aubry Cookman of *Popular Mechanics,* Tom Lippert of Chilton Publications, W. J. Murphy of *Chemical & Engineering News,* John T. Ogden of Ogden Publishing Co., representing the glass interests, Frank Thone of *Science Service,* Volta Torrey of *Popular Science,* and William Lawrence of the *New York Times.*

In addition to the American press representatives aboard, there are a number of foreign press representatives. The men represent Australia, Canada, France, Mexico, Poland, the United Kingdom and Russia. Several other countries including the Netherlands had been asked to send representatives but did not do so.

As later explained in detail on page 117, the mission of the joint task force is primarily to determine the effects of the atomic bomb upon naval vessels in order to gain information for the national defense. Secondary purposes are to afford training for Army Air Forces personnel in attack with the atomic bomb against ships and to determine the effect of the atomic bomb upon military installations of both the Army and the Navy which will be placed upon the target ships.

The Army and the Navy are cooperating together with other branches of the government in these tests, not to prove something or to disprove something or with the belief that the test will once and forever establish whether there will be a great or small Air Force, Navy or Ground Force. The purpose of the test is to seek information acquired by scientific methods from which it will be possible to improve our military and naval equipment and tactics in the unfortunate event of an atomic war. Much information of great value to science, medicine and industry will be obtained.

Dates of Tests

The schedule of target dates calls for the first test to be accomplished on or about July 1 over target ships at some altitude, the exact height will probably remain secret. The second test will follow as soon as possible after the first test with a minimum intervening period of three weeks, and will be a burst at the surface or underneath the surface of the water among the target ships.

The exact target dates depend entirely upon weather and wind conditions. Cloudless skies are desired for accurate bombing. Because of radioactivity in the resulting cloud, it is desirable, for safety requirements, to have the same quadrant wind from sea level to the stratosphere. During the month of July it appears probable that there will be about seven days which will be suitable, from the standpoint of cloud cover, for an air drop; however, some of these days may not be suitable from the standpoint of wind direction. Adequate measures are being taken to insure the safety of personnel engaged in the tests, the observers, inhabitants of nearby islands, and chance travelers by sea or air.

The total number of target ships is in the neighborhood of 80. There will be some battleships, including the Nevada which is to be the central target, two aircraft carriers, a number of destroyers and many other type of craft. The list of targets includes German and Japanese ships as well as the surplus United States vessels. The target ships will be anchored and placed in a manner calculated to give effects varying from purely destruction to negligible damage among the various ships of each type.

Safety Procedure

There will be many unique features in Operation Crossroads which have never before been encountered and, therefore, call for extreme precautionary measures to safeguard personnel. The flash which accompanies the explosion, because of the extremely high temperature involved, is many times more intense than the light of the sun and is capable of causing damage to the unprotected eye, of a temporary, or possibly of a permanent nature. Special protective goggles have been provided for observers who will view the explosion, and only this particular type should be used. If the unprotected eye is exposed to the flash, even at a distance, of twenty miles, it will cause a temporary after image and the observer will not see the interesting "close explosion" phenomenon.

We have been instructed to wear the protective goggles for a period of two minutes before the explosion and to keep them on for at least one minute after the blast. In the Hiroshima blast, it has been reported that the tail gunner in a bomber twenty eight miles distant from the explosion, who was inadvertently looking directly at the explosion, was unable to see for a period of fifteen minutes.

The hazard to live or exploding ammunition carried aboard the target vessels may be a very serious problem, due to exposure to radiation and to fire caused by gasoline and fuel oil, therefore, a minimum number of personnel essential to the operation will be exposed to this calculated risk.

Following the explosion, contamination of the water in the lagoon will occur to a greater or lesser degree and may persist to a dangerous degree from five to seven days due to the slow rate of diffusion and decay of radioactive products. No one will be allowed in the lagoon until it is declared safe by the Radiological Safety Group who will be equipped with instruments to determine the radioactivity present.

The cloud, both visible and invisible, containing vaporized water will present a serious problem from a safety standpoint as it will be highly charged with radioactive particles which will be precipitated from the cloud and prove disabling to personnel should it be ingested or inhaled. These particles are absorbed into the blood stream and eventually find their way into the bone marrow where permanent damage may result. For this reason, only personnel who are especially trained and protected will be present in the area and the observer's ships will be at a great enough distance from the target to enable them to maneuver out of the cloud should the wind shift at higher levels.

So much for some of the technical aspects of the tests. By the time this appears in print, the first test may already have been made and the newspapers may have carried accounts of it. Nevertheless, these aspects of the tests are of considerable importance and interest and it is for this reason that they are presented here.

Naturally, there is great interest in all aspects of the tests among the press representatives aboard the *Appalachian* and most of them are trying to gain all the background knowledge they can in the field of nuclear physics. There is probably a greater concentration of Smyth Reports aboard this ship than in any other place in the world. It is the "Book of the Day" in this part of the world. Every effort has been made by the Public Relations Staff to provide all the background material possible. A most excellent technical library has been placed aboard ship for all to use. In addition, each representative has been given a packet of background data containing everything from charts of the Marshall Islands and Bikini Atoll to Smithsonian Institution reports on the life of natives and animals in the Pacific Islands.

Bikini Atoll—What and where it is

A few words regarding Bikini Atoll may be of interest. Bikini Atoll lies at Latitude 11 deg 31 min North, Longitude 165 deg 34 min East. It is located about an equal distance of 170 miles east of Eniwetok and northwest of Kwajalein in the Marshall Islands. It is 21½ miles long—lying in an east-west direction. There are over 20 islands in the atoll of which Bikini, the principal island, is located at the northeastern extremity. Bikini Atoll as are all the atolls in the Marshalls, is formed exclu-

ATOMICS

sively of coral, built up from submerged peaks which at some time in the geological past have risen close to the surface of the sea. No stone other than coral is found in the Marshalls and there are no minerals other than minor phosphate and guano deposits. The lagoon formed by the ring of islands is shallow, affording an excellent and protected anchorage for ships, and it is for that reason that Bikini was selected as the scene of these tests. The lagoon offers an anchorage for the target ships and the surrounding islands provide bases for measuring equipment.

Prior to evacuation, there were 161 natives on Bikini Atoll. These were of Melanesian and Chammore extraction. These people are closely affiliated with the Polynesians in racial characteristics. In general, their skin is a light brown, the face long and oval and marked by a high forehead and prominent cheekbones. Of interest is the fact that the Marshall Islanders are extremely competent navigators. Of all primitive peoples known they have perhaps developed the art of navigation to the highest degree. Not only do they sail confidently from atoll to atoll within their own archipelago, covering distances often exceeding 400 miles, but formerly they also traveled as far as the adjacent Caroline and Gilbert Islands and back.

Reaction to the Baruch Report

Just prior to this writing, news of Baruch's speech dealing with atomic energy reached us. Landing, so to speak, in a hotbed of atomic interest, this proposal is being widely discussed. In general, the logic of Mr. Baruch's proposal is admitted but the seasoned newspaper men are skeptical as to whether this plan can be carried out. None of them feel that it makes the atomic bomb tests by this task force unnecessary. Many of them think that we may have to adopt some such plan in the end but that the world is not ready for it yet. Many feel that conditions now will result in another great war, an atomic energy war, in a matter of from 15 to 25 years and that only then will such a plan be possible. It is possible they are right. From an idealistic standpoint the Baruch proposal, which is of course what was proposed in the Secretary of State's Report on Atomic Energy, should be adopted but there is still too much tension in the world to permit its being adhered to.

One little sailor was very much worried when the news of the Baruch proposal was posted on the bulletin board. His heart was set upon seeing the atomic bomb tests and now, because of this speech, he thought that his dreams were going to be shattered and that the tests would be called off. We reassured him, however. He felt greatly relieved when we told him that there was no immediate possibility of this proposal being accepted either by the United Nations or even by our own nation—that it would be a matter of years, perhaps before the plan could be made effective, if at all.

SIGNIFICANCE OF ATOMIC BOMB TESTS AT BIKINI

A brief consideration of the reasons for the Atomic Bomb tests to be made at Bikini Atoll in the Middle Pacific in July together with a discussion of the instrumentation features of the project. Much ill-advised comment on these tests has given many people an erroneous impression of them, particularly as regards cost. Instead of costing half a billion dollars as some misinformed people have claimed, the total cost of the entire operation will probably be less than the cost of one new ship

By Andrew W. Kramer ***Managing Editor, Power Plant Engineering***

THERE has been considerable comment in the press and over the radio on the forthcoming atomic bomb tests to be made at Bikini Atoll in July. Some of this comment has been critical, much of it ill-advised. There has, for example, been considerable criticism regarding the costs of these tests. It has been stated by those who have little or no information available that these tests will cost around a half billion dollars — some 400 and some millions for the target ships and another 100 million for other expenses. Actually, these figures have no foundation—they are far from the truth. The first figure is the approximate total of the original costs of the ships.

Now, any intelligent person should be aware of the fact that many of these ships are obsolete and that they were already scheduled for disposal, before the atomic bomb tests were ever planned. This meant only one thing, "the junk heap," or to be laid up for target purposes. As a matter of fact, howeyer, not all these ships will be destroyed because the navy wants to learn the distances at which light damage will be incurred as well as the lethal range of the bomb against various types of ships.

Even if all of the ships were sunk, however, the cost to the taxpayer, for at least 90 per cent of the ships, would be only their scrap value. The scrap value runs from 5 to 15 dollars a ton so when the entire tonnage of the ships is multiplied by say an average figure of 13 dollars a ton, it comes out less than one per cent of the original cost of the ships. It must also be kept in mind that the job of scrapping the ships is a terrific job in itself, the labor cost being very high. Hence, instead of a figure around $400,000,000 we would be lucky to get as much as $4,000,000.

The other figure, $100,000,000 for other expenses has no foundation at all. True, a lot of personnel will be involved in the tests — something around 40,000 men all told, but over 90 per cent of these will be Navy men because the Navy has to furnish the crews to man the 200 odd ships that are involved in the operation. These Navy men would be on duty and receiving pay in any case; it costs the taxpayer no more to have them assigned to this duty.

No official figures have been released on the estimated cost but according to the most reliable sources we can be pretty sure of one thing and that is that the cost of the tests will cost less than the cost of one new ship. The Navy feels that the value in saving the taxpayers' dollar by avoiding its being turned into improductive channels for the wrong kind of ships will be justified.

Another criticism that has been made of these tests is that they are a "martial gesture," a "threat of aggression." A little thoughtful reflection should show that this interpretation of the tests is rather silly. The Navy has got to have certain information regarding the effect of atomic bombs on ships and the only way to get this information is from actual tests. The targets are naval targets. There is only one other big Navy in the World, and she does not think we are going to use the atomic bomb against her.

ATOMICS

Pre-amplifier unit, under test at the Westinghouse Research Laboratories, is the heart of a maze of intricate instruments that will record the force of atomic bomb blasts near Bikini Atoll. Small electrical signals will be picked up from hydrophones, amplified by this apparatus and passed on by high frequency radio transmitters to a recorder many miles from the scene of operations

It is true, some very able scientists in this country have stated that little can be learned from tests such as these, yet that is only their opinion. Others will tell you, with good supporting evidence that a great deal can be learned. It must be remembered that the Navy has no alternative but to regard the atomic bomb as a weapon, both offensive and defensive, which will be used in another war. All of us, including the people of the Navy, hope that before such an atomic war materializes we will have found some way of doing away with the bomb altogether, but until that day arrives, the Navy and, of course, the Army too, must make its plans on the basis that atomic bombs will be used.

Therefore, it is necessary first to know what effect the atomic bomb has against naval vessels. This will provide data for possible required changes in: (1) ship design; (2) tactical formations at sea, and anchoring distances in port; (3) the number and location of operating bases and repair yards; and (4) strategic disposition of ships.

Also it is necessary to test the effect of the atomic bomb against aircraft, both airborne and grounded, and upon a wide variety of military ground weapons and equipment — in order to learn what redesign of any items may be necessary.

Another thing we need to know more about is the various effects of the atomic bomb against living creatures so that we can provide proper protection and early diagnosis and treatment. For these reasons, animals are being used in the tests.

The use of these animals has been criticized but the Navy points out it is more interested in preserving the lives of men in the next generation than animals in this one. The medical officers who are responsible for that preservation of life in the armed forces, and possibly civilians too, if this thing should ever come to a real atomic war say they can't do it properly unless they can get more complete information.

Effect of Atomic Bomb Upon Ships and Their Crews

The various types of effects of the atomic bomb upon a ship and her crew are as follows:

(1) The air blast which tends to crush the above-water structure and kill or maim personnel. And it should be said here, that the atomic bomb is the first weapon that has ever exposed an entire ship to pressure.

(2) Intense heat, affecting the ship's structure, the crew, and possibly the ammunition and fuel.

(3) Radio-activity, affecting the personnel and certain types of equipment.

(4) Possible high waves, endangering both the safety of the ship, especially at anchor, and the lives or health of the crew by throwing water in the form of spray or "green water" nautically, water that is not separated by drops, contaminated by radio-active fission products, upon ships. This might not only knock out the personnel earlier or later, but make ships uninhabitable for a considerable period, even if a relief crew were available.

(5) Underwater shock tending to loosen equipment attached to fixed parts of the ship, and turn all loose objects into projectiles.

(6) Underwater pressure tending to rupture the hull and sink the ship.

The Present Tests

Each of the three tests which the Navy is planning, in the air, on or just below the surface, and the deep underwater shot, will produce two or more of the above effects. Only the first two tests are to be made this summer. While the third, the deep underwater test, is commonly believed to be the most important one, it is by no means certain that it will prove so. The surface or shallow underwater burst may readily turn out to be more lethal in its combined effects upon ship and crew, especially since this attack can be made either at sea or in port.

The deep underwater explosion can be brought into effect only on the high seas, since the weapon must be placed thousands of feet below the surface. To so place an atomic depth bomb, which must be specially constructed to withstand terrific underwater pressures, under a naval task force free to maneuver at high speed, is a job which certainly challenges the ingenuity and engineering skill of the most experienced designers of underwater weapons.

Temperature

One effect of the atomic bomb that is different from that involved in the explosion of ordinary bombs is the effect of temperature. There have been a number of unplanned explosions such as the ones at Halifax and Port Chicago, involving hundreds or even thousands of tons of high explosives. The intense radiation in the atomic bomb blast makes the problem of instrumentation or measurement very difficult and great effort is being taken in this field to get all possible information. The explosion of say, 20,000 tons of TNT in boxes would have quite different effects from that of a single atomic bomb. That would be a much lower temperature explo-

ATOMICS

sion. There, also, would not be the intense gamma radiation which tends to make photographic film black just before it gets its most important record. All of these things make the problem of instrumentation difficult.

As far as the ships involved in the forthcoming tests are concerned, they are the primary gages. A ship is a complicated gage as a whole; it gives the gross effect and that, of course, must be observed with difficulty from a distance. There are available, however, cameras, television, and many photographic and graphic and mechanical instruments which will record what happens on the ships.

There is another important point. The ships, even without crews are alive in the sense that they have chemical energy in them. Chemical energy has shown itself very markedly in this war. When a ship is struck and set afire all of the chemical energy in her fuel and also the energy in her explosive cargoes made itself apparent in very strong terms.

That constitutes a great difference from an ordinary uncomplicated steel hull or tank which might be used as a mechanical pressure gage. It will be necessary to take this fact into consideration in placing the ships at Bikini Atoll because little information would be gained if all the ships burned up as a result of a fire chain reaction.

It is not possible here to go into detail in regard to the various instruments that will be used or methods used in handling them, but the instrumentation project is very elaborate. Some 1000 people—trained scientists, technicians, Army and Navy technical officers, assistants, etc.—are involved in the instrumentation group. Some of the instruments are very simple, such as five-gallon gasoline cans which will be used to measure the blast at various locations. Others are extremely complicated, such as tourmaline crystal gages for recording pressures and connected to radio transmitters which will send their signals out by telemetering devices.

Air pressure data will be secured by 36 gages which will transmit air pressures from 18 positions on each of two target ships over radio channels. Electrical impulses from each of these 18 gages on a radio channel will be examined by an electronic commutator every few millionths of a second and transmitted successively from each gage to two receivers on the mother ship. A brass bellows in each gage will stretch a resistance strain gage when compressed by the blast of air. This strain gage in turn will frequency modulate a radio transmitter by means of a reactance tube.

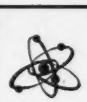
Similarly water pressures (in the second atomic bomb test) will be measured by six tiny tourmaline crystals sealed at the ends of rubber cables and the impulses so obtained sent over six separate radio transmitters in a target ship.

Because sound travels between three to four times as fast in water as it does in air, the impulses from these tourmaline "pickups" will be that much more rapid, and the transmitters and receivers must be exceedingly precise. Three cathode-ray tubes will pick up the picture made by the impulses and they will show as curves on the fluorescent screens. To photographs these traces, two very high speed cameras are installed in the recorder. Changes that occur in a fifty-thousandth of a second are photographed by the cameras which uses up film at the rate of 40 ft a second.

There will be Geiger counters in various locations which will send out a continuous record of the radioactivity at those places so that we will get a record instantaneously at the observing ships of the intensity of radiation and the way in which it dies away.

In short, no single experiment has ever been made where so many different kinds of things were measured at once. It will be the most complicated laboratory set-up which has ever been undertaken in a remote part of the world. Never has there been so much training and so much rehearsal for a single task by so many men. For months now, various groups have been at work, on the scene at Bikini Atoll, on Kwajalein where the air forces will be stationed, and in laboratories and factories in various parts of the world, preparing for this job.

After the experiment is over, we will know some of the answers right away but it will take months, perhaps years, before we will get all of them. Those in charge of oceanography feel that it will be many years, if ever, before they obtain all the oceanographic data the experiment will provide. This implies that there might be permanent changes out there that cannot be fully appraised in our generation.



ATOMICS

A Report Direct from the Atomic Bomb Test Expedition en route to Bikini

1946 JUN 18 AM 6 12

POWER PLANT ENGINEERING -
53 WEST JACKSON BLVD CHGO -

180959Z VIA NAVY RADIO ABOARD THE USS APPALACHIAN JUNE 17 1946.
DURING THE FIRST LEG OF OUR JOURNEY TO BIKINI FOR THE ATOMIC BOMB TESTS THE HUNDRED ODD PRESS CORRESPONDENTS ON THIS SHIP HAVE BEEN BRUSHING UP ON THEIR NUCLEAR PHYSICS. THERE IS UNDOUBTEDLY A GREATER CONCENTRATION OF SMYTH REPORTS ABOARD THAN ANYWHERE ELSE ON EARTH. GREAT INTEREST CENTERS ON THE PROBABLE EFFECT ON MARINE LIFE AND ON GEOLOGIC STRUCTURE. IN A TWO-WAY RADIO CONFERENCE BETWEEN THE PRESS REPRESENTATIVES ABOARD THIS SHIP AND THE SCIENTIFIC OBSERVERS ON THE USS PANAMINT A MILE AWAY, THE SCIENTISTS ANSWERED MANY QUESTIONS FIRED AT THEM BY THE REPORTERS. THERE SEEMS TO BE LITTLE DANGER OF ANY LARGE SCALE DAMAGE EITHER TO MARINE LIFE OR TO THE ISLAND STRUCTURE. CONSIDERABLE INTEREST ALSO CENTERS AROUND THE BARUCH PROPOSAL. WHILE MOST OF THE REPORTERS AGREE THAT SUCH A PLAN WOULD BE IDEAL THEY DO NOT SEEM TO THINK THAT, WITH THE PRESENT TENSION IN THE WORLD, IT CAN BE BROUGHT ABOUT. IN THE MEANTIME ALL ARRANGEMENTS FOR THE TESTS ARE GOING AHEAD FULL BLAST. THIS SHIP IS EQUIPPED WITH EVERY MEANS OF COMMUNICATION TO PROVIDE FAST TRANSMISSION OF THE NEWS OF THE TESTS TO YOU BACK HOME.

ANDREW W KRAMER USS APPALACHIAN.

Are We Winning The Peace?

(Continued from page 69)

amount of reconversion before the beginning of 1946, these figures should probably be applied to 1946 instead of 1947. It seems highly probable that even in spite of the delays in production resulting from labor troubles and shortages of one kind or another, this forecast may be very nearly realized in 1946.

As remarked before, there need be no present fear that excess profits will swell reserves to a danger point since, for the time being, the need for new investment is very heavy.

It is believed that the current wave of strikes is producing a variety of effects not anticipated or desired by the participants. It is, of course, perfectly obvious that strikes which postpone production postpone the time that at which everyone—including the strikers—will be able to enjoy the fruits of their labors. Since price controls to be effective must continue until a level of production is reached at which the laws of supply and demand can be effective, strikes which postpone production also postpone the time at which price controls can be safely removed.

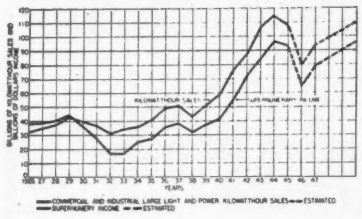


Chart 3. Variations in commercial and industrial large light and power kilowatthour sales and supernumerary income (that is, income in excess of the amount needed to operate the economy)

Labor strikes in an effort to secure a larger fraction of the industrial dollar are based on a misconception of the current economic scene. Rising wages which must be passed on in higher prices are merely inflationary.

That inflation is not something which can be avoided, however, because we already have it. There is no known method of deflation which is not an extremely painful process. Actually, long continued strikes are deflationary. If all our wartime savings were to be dissipated by strikes, there would be no further competition among buyers tending to force prices up; and the need for the continuation of the O. P. A. would disappear.

However, such a dissipation of surplus spending power is an exceedingly unpleasant form of deflation. To avoid, then, a repetition of the 1919-1920 boom and bust, our reconversion program should be completed and every effort possible made to swell the output of goods and services. For several years it would be possible to employ the long hours of our wartime production schedules—with the corresponding high take-home for the workers involved. That is probably what is being done in Russia, and it will result in their reaching a higher state of industrialization than the United States if we do not work equally hard.

On the other hand, many of our people will probably prefer more leisure to enjoy the fruits of their labors—even at the risk of losing some of our margin of production which we have over the Soviet Union.

If high levels of production are reached with prices which do not provide excessive profits, industry will be encouraged to expand production only as far as required by the consumption capacity of the country. It is to secure a measure of what such production goals should be that the original estimates of Chart 1 were prepared—and also the estimates in "Markets After the War" and in "American Industry Looks Ahead."

Chart 2 breaks down the figures for 1947 substantially as is done in Chart 1. These figures represent the growth that is possible in our gross national product and in living standards without further inflation—and, it is hoped, without the precipitation of a boom and bust cycle.

Incidentally, since this is a power conference, we have brought up to date Chart 3, showing the relationship between income and commercial, large light and power sales of electric energy.

I believe this rosy prospect is within our grasp, but it cannot be expected to come by itself; and, certainly, if past cycles are any guide, we cannot expect these high levels to be maintained on any basis without considerable work on someone's part.

In the past, we engineers have been all too content to work on our technical developments, leaving the use to which these technical developments are to be put to the laity who cannot reasonably be expected to understand what our technological age can accomplish.

By the same token, two world wars should be enough to convince engineers that we also must assume the social responsibility for our acts. The laity—including labor—cannot be expected to understand the possibilities and limitations of modern productive machinery. Engineers alone know what is possible of accomplishment with what we know today. Since we possess the knowledge of what can be done and the know-how to do it, it is more or less up to us to determine what use is to be made of the productive machine. We have not, in the past, taken a very prominent hand in dictating the use to which our efforts are to be put. We shall also have to devote much more effort than in the past to formulating an overall program and carrying it out.

Water Treatment

(Continued from page 81)

cent of boiler troubles and the sole cause of such difficulties in about 50 per cent of the cases.

"—we have found that a properly designed system of feedwater treating is not always the solution to the problem. It has become apparent that more emphasis should be placed upon the routine water analysis and the training of the men who carry out this work."

Selecting operators amenable to training and providing talent capable of giving instructions are pre-requisites of any training program.

Selecting of Operators

Experience indicates that young operators are usually easier to train than more experienced men. At least some high school training is believed essential. Impaired vision, especially color blindness, natural awkwardness, and an aversion for such work are conceived to be prohibitive limitations. Individuals with a flair for experimentation without seeking counsel are regarded as poor risks.

Technical Counsel

Technical counsel should have as its purposes not only the initial instruction of operators, but also to keep them instructed. Unless such coaching is provided, even good operators are likely to invent short-cuts that are unwarranted, to develop erroneous theories, and to forget. A good operator who conscientiously questions the validity of a given operation is entitled to a reasonable explanation.

Instructions along these lines need not and should not be in the form of academic lectures on chemistry. Nor should they be offered in large doses. Spoon feeding is far more effective.

Even in an "elaborate" processing system, seldom are more than four major operations involved, i.e., softening, alkalinity adjustment, degasification, and blowdown control. The major and minor purposes of each can be demonstrated by means of a flow chart as shown in Fig. 4. If, subsequently, the control tests are attached, a working picture of the water processing system is obtained.

The ritual to be followed in the operation of various pieces of equipment and their limitations may best be detailed in the form of an operating manual, a copy of which should always be available.

Therein may also be included an elementary discussion of the chemistry involved and an outline of the chemical test procedures to be followed.

The old bromide that providing technical talent necessary to these ends is too costly is not valid. That the dividend to be realized from different methods of treatment is increased by providing technical counsel is attested by the data in Fig. 5.

All Clear AFTER 9,000 HOURS

SUN DIESEL LUBRICANT...

Keeps Rings Free in Big Diesels for More than One Year of Continuous Operation

More than a year of continuous running, day and night . . . no stuck rings . . . no heavy sludge . . . no hard carbon . . . that's the record of a "Job-Proved" Sun Diesel lubricant in a big industrial power house.

The picture above shows a piston from one of the company's two 750-h.p., 6-cylinder, 4-cycle, Worthington Diesels after 9,000 hours of operation. The engine was shut down at this time only for routine inspection.

Performance like this is typical of the results being obtained by hundreds of Diesel operators in plants throughout the country, and in all types and sizes of Diesel.

Sun Diesel Lubricants have proved their ability on the job. They have extremely high resistance to heat, with minimum tendency to form gum or hard carbon. For continuous power output and low maintenance costs, call the Sun office near you today.

SUN OIL COMPANY • *Philadelphia 3, Pa.*

Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS

Fibrous Glass

(Continued from page 90)

twisted into cords and woven into tapes, cloths and sleevings.

Impregnated with a suitable varnish, these materials have an extremely small space factor and great resistance to high temperatures and moisture penetration. They are an essential aid to design engineers in their efforts to give electrical equipment greater stamina and reduce the size and weight of units required to do a given job.

In the maintenance field, Fiberglas electrical insulation has proved its importance. In many instances, rewinding with glass insulation has eliminated breakdowns and permitted continuous operation under heavy overloads.

In a mid-West steel plant, roller table motors are separated by only a few inches from steel ingots heated to 2300 F. Crane motors, also, are subjected to excessive heat, and both are subjected to the presence of steel dust in the air. Some five years ago, the practice of rewinding the motors with Fiberglas insulation after breakdown was adopted. Approximately half of all the motors have now been rewound with glass. Rewinding has involved no design changes. The other motors will be rewound with glass as breakdowns occur.

An outstanding seven-year record of service by motors and generators wound with glass insulation has been marked up by a large cement manufacturing company in Southwestern Ohio. Failure of a 40-hp slurry pump motor wound with organic insulation occurred four times over a period from 1934 to 1939. In 1939, the motor was rewound with glass, and to date no failure has been reported. Other motors and generators in the plant that have been rewound with glas have established similar records of performance.

Silicone Varnishes

One of the most recent developments in varnish impregnants has been the commercial production and use of high-temperature silicone resins by several companies. Labratory tests and tests on finished equipment indicate that these resins can withstand total temperatures nearly 50 deg higher than other varnishes.

Silicone resins, in general, bond extremely well to glass. Several wire companies are now supplying Fiberglas insulated magnet wire with silicone varnish impregnation. Varnished Fiberglas cloth, treated with silicones, is available, as are saturated sleevings and varnished tubings. In certain types of glass-mica combinations silicones are used both in building up the mica flakes and in the varnish treatment of the glass cloth backing.

All of these products make it possible to build equipment which will operate for long periods of time in extremely high ambients, or which can be made much smaller than other equipment because of the ability of the impregnants and their fibrous glass bases to withstand the heat generated internally by working the conductors that much harder. They provide the design and maintenance engineer with an entirely new set of high temperature insulation tools.

Fiberglas Air Filters

Composed of relatively coarse glass fibers coated with an adhesive and known as "Dust-Stops," Fiberglas air filters catch dust particles as the air moves through them. The direction of the air flow is changed many times, the clean air readily passing through; but the dust has so much inertia that its direction of flow is not easily changed and it remains entrapped in the viscous film. The viscous adhesive employed has extraordinary wetting power. Each particle of dust that impinges on the adhesive becomes quickly soaked through and acks like a wick to carry the adhesive to other particles of dust. This capillary action makes the filter effective even when quite heavily laden.

The smooth, round glass fibers offer very little frictional resistance to air flow. The result is a comparatively low pressure drop across the filter. The resistance of a single filter 1 in. thick, when clean, averages approximately 0.085 in. H_2O and the resistance of a single filter 2 in. thick, 0.14 in. H_2O.

Glass fibers the basic filter medium will withstand exposures to temperatures of 1,000 F. before they begin to soften enough to weaken the resistance of the pack to the air pressure encountered in the plenum chamber.

The dust-catching adhesive (Lindol) used on the glass filter pack offers high degree of fire safety. The adhesive has no flame-point, that is, it will not ignite from an external flame. Its flash-point, the temperature at which flame will originate when the adhesive is heated, is 450 F.

In what is believed to be the world's largest air conditioning installation, Fiberglass air filters have been used to clean the 30,000,000 cu ft of air per minute circulated through 18 miles of buildings and vaults at the Oak Ridge, Tenn, atomic bomb plant.

Details of the manufacture of glass fibers and their fabrication into insulation, textiles and other products are given in an article entitled Fiberglas, by William H. Page, in *Compressed Air Magazine,* August, 1945.

[1] The K factor of any substance is its thermal conductivity, the rate at which heat will be transmitted through it, usually expressed in terms of Btu per sq ft (of cross-section) per in (of thickness) per deg F (temperature difference between hot and cold sides).

[2] For detailed instructions, based on Commercial Standard CS 117-44, on how to apply all forms of mineral wool and fibrous glass insulating materials, see Insulation —How to Intall It; Power Plant Engineering, September, 1944, pages 96-100, 162, 164.

[3] Proceedings of the Rhode Island Industrial Health Institute, held in Providence, May 19, 1943.

Fire Losses

Over 90 per cent of all fires can be prevented by proved safety principles, requiring little time or money, according to a statement made recently by the National Fire Protection Association.

Large loss fires (fires exceeding $50,000 loss) have skyrocketed 48 per cent in the last three months in the United States and Canada.

An analysis of the 329 fires shows the following:

Detection: The following interesting figures are presented on who discovered these fires and how they were reported to the Fire Department:

Employees or Occupants	131
Outsider or Passerby	108
Watchman	27
Explosion	20
Police	19
Unknown	19
Automatic Alarm	5
Total	329

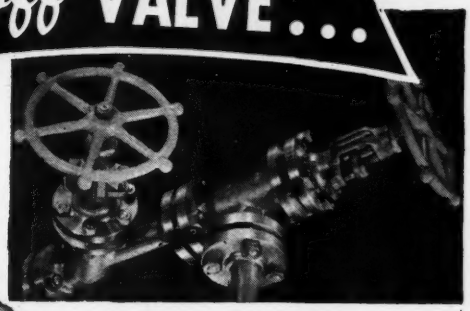
Telephone	196
Street Box Alarm	55
Unknown	44
In Person	18
Automatic Alarm	5
Police Radio	4
Fire Siren	4
Detected at Station	2
Sprinkler Water Flow Alarm	1
Total	329

Time of Fires: 98 fires started between midnight and 6 a. m., 78 between 6 p. m. and midnight; combined, this means 176 occurred during periods of normal inactivity and darkness. 130 fires broke out during daylight hours (6:00 a. m. to 6:00 p. m.) when the human element was most active. In 23 cases the time of fire was not reported. (Total: 329)

Causes of Fires: A casual analysis shows a disproportionate number of "Unknowns." Influencing this is the fact that about 65 per cent of these fires resulted in total loss thus destroying evidence.

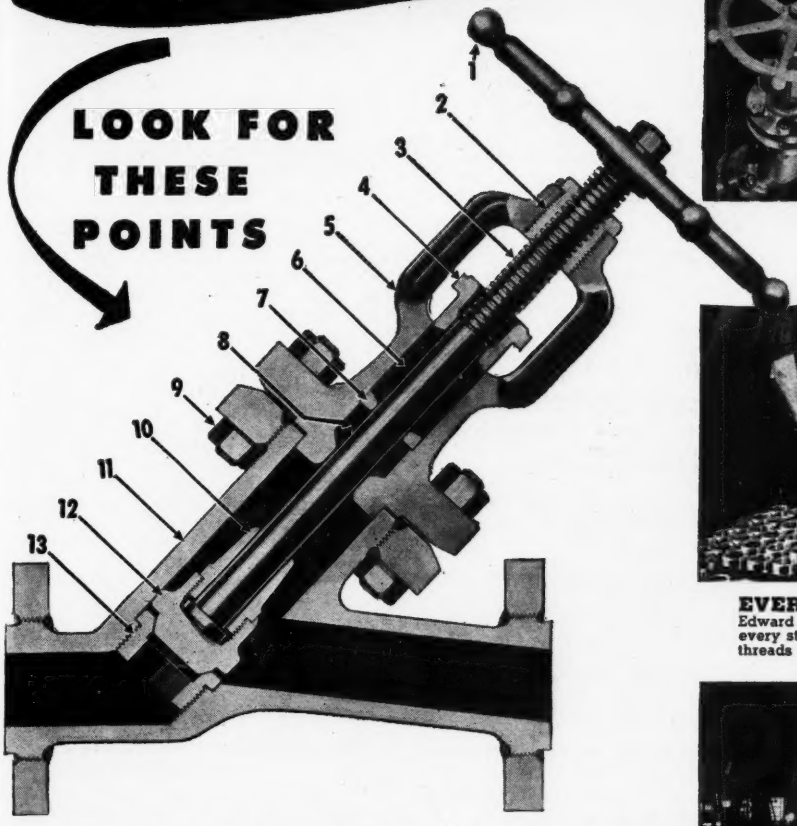
Unknown	158
Heating Defects	50
Electrical Causes	30
Flammable Liquids	19
Smoking	16
Welding	12
Spontaneous Ignition	8
Incendiary or Suspicious	8
Spread from Trash, Rubbish, or Grass Fires	7
Miscellaneous Special Hazards	7
Kitchen Hazards	5
Sparks	4
Vehicle Accidents	2
Friction Heat	2
Lightning	1
Total	329

How to buy a *Blow-off* VALVE . . .



FIT ANY SPACE. Edward steel blow-off valves are built in both straight-way and angle design, offering a variety of hookups to fit installation space needs.

LOOK FOR THESE POINTS

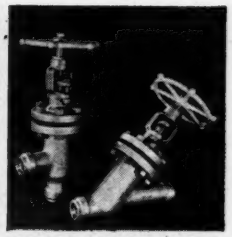


EVERY-STAGE INSPECTION. Rigid Edward inspection procedures check all parts at every stage of manufacture. Inspector above gages threads of wear resistant EValloy valve seats.

FORGED. Drop hammers forge many parts of Edward blow-off valves for top strength in hard usage.

SYMMETRY. Fine-finish, perfect symmetry of EValloy stems is achieved by centerless grinding.

BORIZED. Mating blow-off seats and disks are precision borized at exact angles in same operation.



WELDING ENDS. Socket welding ends, as well as flanged ends, are available in Edward blow-off valves.

1 Handwheel. Strong, knobbed, easy to grip even with wet hands. Oversize dimensions make operation easier.

2 Yoke Bushing. Bronze. Completely machined in one set-up so internal and external threads are perfectly concentric.

3 Stem. EValloy stainless steel with low coefficient of expansion to prevent loosening in cooling.

4 Gland. Forged steel, smoothly machined to prevent binding or scoring.

5 Bonnet. Forged steel, integral yoke post design to prevent misalignment.

6 Packing. Die formed temperature resisting EValpak.

7 Junk Ring. Accurately fitted to stuffing box.

8 Cooling Chamber. Large condensate chamber to protect packing.

9 Studs and Nuts. Through bolted joint makes disassembly simple.

10 Disk Nut. Heavy steel with backseating surface for repacking under pressure.

11 Body. Streamlined steel body with no unnecessary parts to clog or erode.

12 Disk. EValloy stainless steel or Stellite hard facing, precision borized with mating seat.

13 Seat. EValloy or integral Stellite seat, mated with disk.

Built in three pressure classes—300 lb., 600 lb. and 900-1500 lb. sp.

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

Write today for New Catalog 12-D covering Edward blow-off line.

NEWS *from* THE FIELD

National Metal Congress

THE 28TH ANNUAL National Metal Congress and Exposition will be held in Atlantic City's Municipal Auditorium for five days beginning November 18th, according to an announcement made recently.

Meeting jointly during the NMCE will be the American Society for Metals, the Iron and Steel Division and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, the American Welding Society and the American Industrial Radium and X-ray Society.

Study Cleveland Smoke

THE COAL PRODUCERS COMMITTEE for Smoke Abatement is completing arrangements for a survey of the heating and power plants in Cleveland. The survey will be made in cooperation with the Citizens Air-Purification Committee of which Warner Seeley is chairman.

At a meeting of the Committee attended by H. B. Lammers, Director of Engineering of the Coal Producers Committee for Smoke Abatement, it was decided to make the survey on what might be called a "postage stamp" basis which means that numerous small areas would be selected on a geographical basis and all the plants in those areas included in the survey. In all about 300 plants will be surveyed.

American Viscose to Build Plant

AMERICAN VISCOSE CORP. has placed orders for certain power house equipment, including turbines and generators, for its proposed new rayon staple fiber plant at Radford, Va. The time of starting construction work on the plant buildings has not yet been decided upon.

These orders cover the long-term delivery items of equipment on which present delivery promises range up to 24 months in some cases. By placing the orders now considerable time may be saved when the final construction program is authorized.

LeClair President of Western Society

TITUS G. LECLAIR, chief staff engineer, Commonwealth Edison Co., has been elected president of the Western Society of Engineers for the year 1946-47 and was inducted at the 77th annual dinner meeting of the Society at the Chicago Bar Association.

William V. Kahler, general manager, Illinois Bell Telephone Co., becomes First Vice-President, Verne O. McClurg, consulting engineer, firm of Mundie - Jensen - McClurg, becomes Second Vice-President and M. W. Casad, plant extension engineer, Illinois Bell Telephone Co., was re-elected Treasurer and Leigh S. Keith remains as Secretary.

New members of the Society's board of Directors are J. de N. Macomb, ass't to vice president, Inland Steel Co., and Henry Penn, district engineer American Institute of Steel Construction. Dr. Henry T. Heald, president Illinois Institute of Technology, is the retiring president.

The special features of this meeting will be the presentation of the Octave Chanute Medal to Dr. Ovid W. Eshbach, Dean of Northwestern Technological Institute. The medal is given each year for the best paper of an engineering subject presented before the Society. Dr. Eshbach's prize winning paper was on post-war engineering education.

Honorary membership certificates of the Western Society of Engineers will be bestowed upon Charles B. Burdick and William S. Monroe for outstanding service to the engineering profession.

Tube and Pipe Recommendation

PRINTED COPIES of Simplified Practice Recommendation R217-46, Copper Water Tube and Copper and Brass Pipe, are now available, according to an announcement of the Division of Simplified Practice of the National Bureau of Standards.

The recommendation covers copper water tube and copper and brass pipe intended for plumbing uses. It establishes a simplified list of types and sizes for regular stock purposes. Dimensions and weights of the tube and pipe are given, as well as the recommended tempers for copper water tube.

Printed copies of Simplified Practice Recommendation R217-46 may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 5 cents each.

Silicone Rubber in Light Fixtures

LIGHTING FIXTURE manufacturers are displaying interest in the possibilities of silicone rubber for many types of lighting products, according to engineers of the General Electric Chemical Department, producers and fabricators of the new material.

Engineers state that the interest of the lighting fixture manufacturers is based on the unusual heat resistance of the material which makes it extremely applicable as gaskets for searchlights, floodlights, explosion-proof lighting and conventional lighting fixtures. Whereas hot dry air encountered in lighting applications promotes surface oxidation and cracking of natural or ordinary synthetic

COMING EVENTS

National Assn. of Power Engineers—National Power Show; to be held in Cleveland at the Cleveland Public Auditorium, August 19 to 22, inclusive.

National Assn. of Power Engineers—Annual convention of the NAPE; to be held in Cleveland at the Public Auditorium, August 19 to 22, inclusive.

American Chemical Society—National Chemical Exposition, sponsored by the Chicago Section of the Society; to be held September 10 to 14, in the Chicago Coliseum.

National Chemical Exposition—Biennial Exposition, sponsored by Chicago Section of American Chemical Society; to be held September 10 to 14 in Chicago Coliseum.

Instrument Society of America—"Instrumentation for Tomorrow" exhibit; to be held in Pittsburgh at the Hotel Wm. Penn, September 16 to 20.

American Society of Mechanical Engineers—Instruments and Regulators Committee; meeting to be held in Pittsburgh at the Hotel Wm. Penn, September 16 to 20.

National Electronic Conference—Conference sponsored by Illinois Institute of Technology, Northwestern University and the Chicago Sections of AIEE and IRE; to be held at the Edgewater Beach Hotel in Chicago, October 3 to 5.

American Welding Society—1946 annual meeting to be held in New York City, October 24; headquarters not yet announced.

Seventh Annual Water Conference—Sponsored by the Engineers Society of Western Pennsylvania; to be held in Pittsburgh October 28 to 30, with headquarters at the Hotel William Penn.

Refrigeration, Air Conditioning Show—Sponsored by Refrigeration Equipment Manufacturers Assn.; to be held in Cleveland, October 29 to November 1, in the Public Auditorium.

American Welding Society—1946 annual meeting (reassembly) to be held in Atlantic City, November 17 to 22; headquarters at Municipal Auditorium.

National Metal Congress and Exposition—To be held in Atlantic City, November 17 to 22, headquarters at Municipal Auditorium.

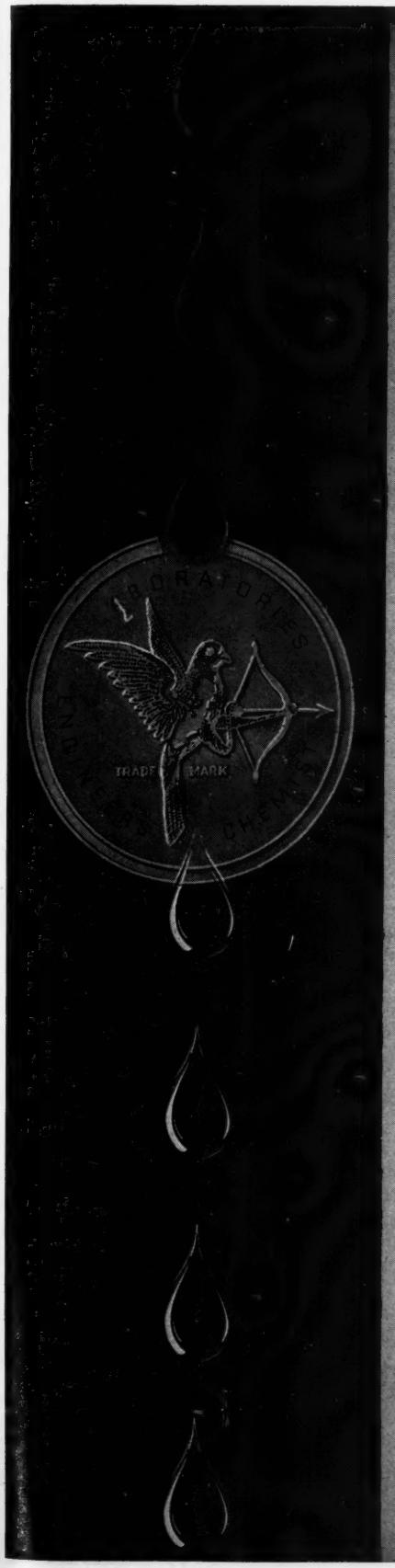
Power Show—17th National Exposition of Power and Mechanical Engineering; to be held in New York City, at the Grand Central Palace, December 2 to 7.

ASME—American Society of Mechanical Engineers; mid-winter meeting, to be held December 2 to 7.

Heating and Ventilating Exposition—7th International Heating and Ventilating Exposition; to be held January 27 to 31 in Cleveland at Lakeside Hall.

Electrical Engineering Exposition—Annual show (Postponed since 1941) to be held in New York City, January 27 to 31; headquarters at 71st Regiment Armory, Park Ave. and 34th St.

AIEE—American Institute of Electrical Engineers; winter convention to be held January 27 to 31.



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EVERY STEP in Water-treatment Engineering, from the gathering, sending in, and classification of Water-samples, to the formulation and application of a correct and adequate method of treatment, including a system of continuous, accurate control, we regard as work for fully qualified technicians.

We therefore maintain a complete staff of Engineers and Chemists, with a background of over 60 years in this highly technical field.

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rubbers, the silicone product will withstand this condition without any change in surface hardness or flexibility. During the war, General Electric produced thousands of silicone rubber searchlight gaskets which proved entirely satisfactory during continuous operation at 340 F and also gave excellent gasketing protection at —50 F.

National Instrument Conference

OVER 1500 instrument men and engineers are expected to attend the First National Instrument Conference and exhibit of The Instrument Society of America, which will be held in the Wm. Penn Hotel, Pittsburgh, September 16-20, 1946.

Albert Sperry, president of the Instrument Society of America, in urging attendance at the "Instrumentation for Tomorrow" conference and exhibit, pointed out that now is the time to make plans for the long-awaited day when industry will aggressively resume production free of all restrictions.

The general chairman of the conference, R. J. S. Pigott, has arranged an interesting program consisting of 15 sessions covering the following subjects: Measurement and Automatic Control in Industry, Plant Instrument Department Practices, Inspection and Gaging, Scientific Measurements, Research in Instrumentation, Physical Testing, etc.

Paul Exline, chairman of the exhibit committee, advised that up to May 1, 80 manufacturers had made reservations and advised that they plan to show many new and improved instruments and controls perfected during the war.

Lincoln Foundation Award Program

THE JAMES F. LINCOLN Arc Welding Foundation has announced a $200,000 Award Program for technical papers as a means of encouraging further scientific progress in the arc welding industry. The award program closes in one year, at midnight June 1, 1947. Rules and conditions governing the activity may be obtained from the Foundation Secretary, Cleveland 1, Ohio.

Valve Standards

A PROPOSED Simplified Practice Recommendation for automatic regulating valves, submitted to producers, distributors and users last November has been approved for promulgation according to an announcement of the Division of Simplified Practice of the National Bureau of Standards. It is effective from April 1, 1946 and will be identified as R219-46, Automatic Regulating Valves.

Mimeographed copies of the proposed recommendation may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

Cement Bureau to Assist Users

THE ESTABLISHMENT of a Conservation Bureau, headed by Ezra C. Wenger, has just been announced by the Portland Cement Association. Mr. Wenger has been regional highway engineer for the Association in six midwestern states for the past 11 years.

The new Conservation Bureau is set up to correlate technical information and assist users of concrete in the fields of water supply, sewage disposal, flood control, river and harbor development, shore and beach protection, soil erosion control, drainage, irrigation, reclamation, hydroelectric developments and similar activities.

Brown Heads Pump Manufacturers

AT ITS MEETING held on February 5, 1946, in the Hotel Stevens, Chicago, Ill., the National Association of Vetrical Turbine Pump Manufacturers elected Arnold G. Brown, manuager of the Pump Division, Fairbanks, Morse & Co., as its president and Joe Downs of A. D. Cook, Inc., Lawrenceburg, Ind., as vice-president.

New Member for Smoke Abatement

THE Northern West Virginia Coal Association of Fairmont, W. Va., is the latest producer group to join the Coal Producers' Committee for Smoke Abatement. Final action on joining was made on March 1st by the Board of Directors of the Association.

The Coal Producers' Committee for Smoke Abatement is starting its fourth survey, since it was reactivated on November 1, 1945, in Youngstown, Ohio, Tuesday, March 12, 1946. Other surveys have been completed in Toledo, Akron and Cincinnati.

Bituminous Coal Research, Inc., recently announced the addition of Carl S. Westerberg of Webster Groves, Mo., to its Pittsburgh office staff. The appointment is effective at once. Westerberg succeeds Ralph H. Hopp, who resigned last year to become librarian of Battelle Memorial Institute, Columbus, O. A former employee of Utah Fuel Co., Salt Lake City, Utah, and the Illinois State Geological Survey, Urbana, Ill., Mr. Westerberg has been engaged in bituminous coal activities since he was graduated from Knox College, Galesburg, Ill., in 1931.

Harold L. Geiger, head of the Chicago Technical Section of the Development and Research Division of The International Nickel Co., Inc., has been elected Chairman of the Chicago Chapter of the American Society for Metals for the year beginning September, 1946. During the past year he served as Vice Chairman of the Chicago Chapter.

Announcement was made recently that Walter C. Edge of Paul B. Huyette Co., Philadelphia, was elected president of the Philadelphia Engineers Club.

Model of 10,000-kw Gas Turbine Plant

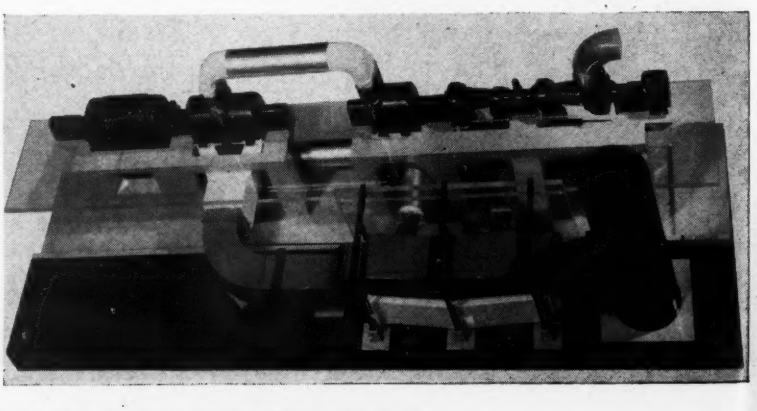
SCALE MODEL GAS TURBINE, shown herewith, believed to be the first commercial design actually proposed for power generation in the utility field, illustrates how Allis-Chalmers engineers expect to build a high temperature, high-efficiency version of the most recently-developed type of prime mover.

Designed for operation at 1300 F, the new 10,000-kw gas turbine driven power generating unit will have an efficiency of about 31 per cent, according to R. C. Allen, manager and chief engineer of the Allis-Chalmers steam turbine department. With all of the extensive Allis-Chalmers experience gained from Houdry gas turbine, aircraft turbosupercharger and the recently announced Navy experimental gas turbine developments incorporated in the new design, operation at the 1300 degree temperature represents a marked advance.

At the same time the company proposed another 10,000-kw unit to operate at 1000 F, with the same guarantees as offered with comparable steam turbine units. Although the guarantees will call for efficiencies of 15 to 20 per cent, it is believed that such a unit will have an application in the power generation field.

Modeled on a scale of ½ in. to a foot, the high efficiency unit shown will occupy an actual area of about 4500 sq. ft.

The model, made of wood, metal and plastics from dozens of detail drawings, was built by Brooks Stevens, industrial designer.

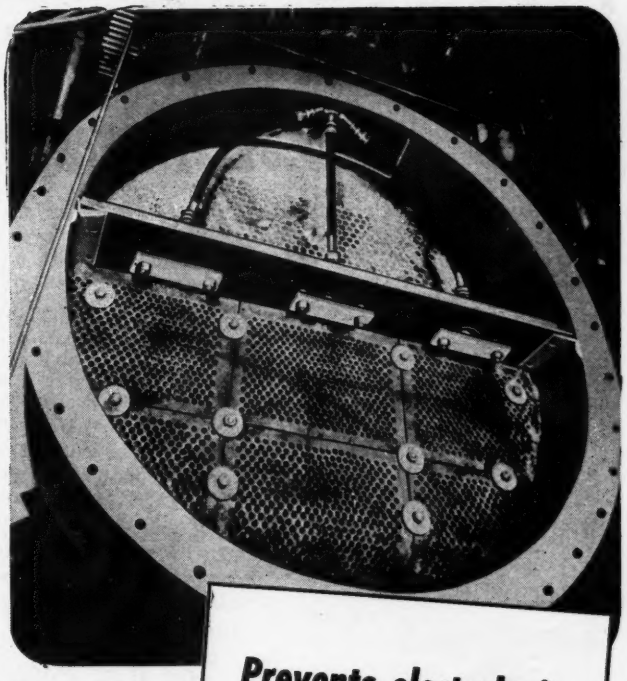


Condenser Tube Life TRIPLED

CONSECO

AIR and EROSION ELIMINATOR

Proven effective by 15 years' service



Installation of a Conseco Air and Erosion Eliminator in condenser water box.

If your condenser tubes deteriorate rapidly due to dezincification, electrolysis or erosion, a Conseco Air and Erosion Eliminator offers you a simple, positive, inexpensive solution. The unit consists of a frame, containing perforated plates (deaeration screens) of special metal, which is easily built into the water box facing the sheet. Gases in circulating water passing through the plates are liberated and discharged through a manifold. Liberated gases attack the easily replaceable, inexpensive plates instead of the tubes and tube sheets. Electrolysis, dezincification, and tube erosion are stopped. Over 15 years of successful service proves that tube life is increased at least three times normal. Write or phone for details.

Prevents electrolysis

Resists dezincification

Stops air erosion

Triples life of tubes

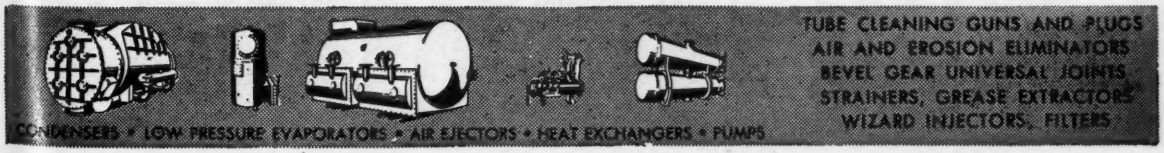
Proven successful in service

A highly skilled, specially equipped service organization, ready for immediate action anywhere on the continent, backed by engineering and manufacturing facilities producing over 3,000,000 sq. ft. of heat exchangers annually.

SERVICE

CONDENSER SERVICE & ENGINEERING CO., INC.

71 RIVER ST., HOBOKEN, N. J. **Phone HOboken 3-4425** **After 6 P.M. or Sundays-HOboken 3-4428**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STRAINERS, GREASE EXTRACTORS
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To get *more* for your valve dollar

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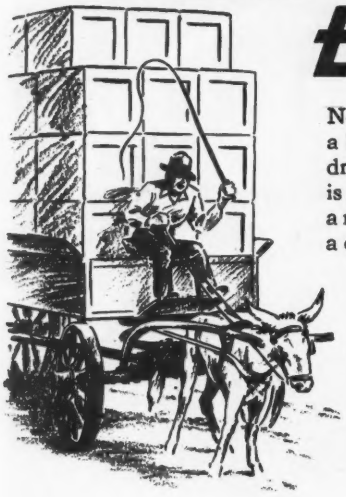


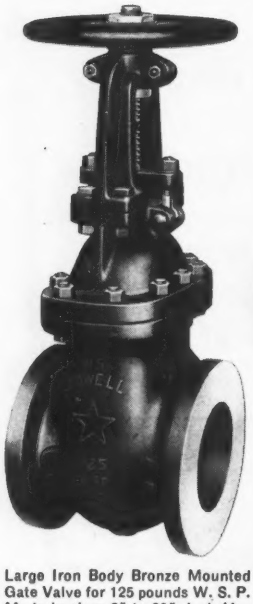
No one would expect a burro to pull a load that requires a heavyweight draft horse. But a sure-footed burro is just right for carrying a pack on a mountain trail where the power of a draft horse would be wasted.

And yet when it comes to valves, such "misapplication" is often encountered. *Many cases of failure are directly due to expecting service from a valve which it was not designed to give.* Consequent replacements are costly. On the other hand, it is not sound economy to use a valve of more expensive construction than the particular service requires. The Powell Line* of Bronze, Iron, Cast Steel and Corrosion Resistant Valves, is so *complete* that there's a POWELL Valve that's *just right* for every flow control condition encountered in modern industry. When you need valves for new installations or for replacements, don't risk "misapplication". Consult POWELL Engineering and *get more for your valve dollar.*

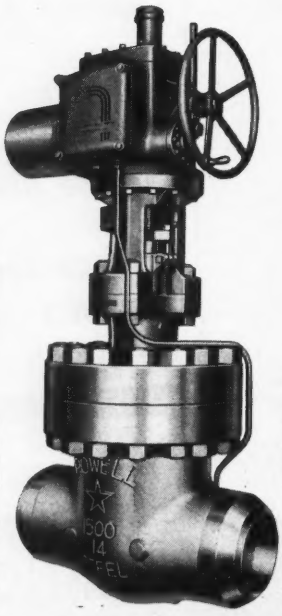
The Wm. Powell Company, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

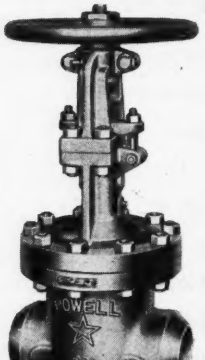
*In writing for catalogs kindly specify the service conditions under which the valves, in which you are interested, must operate.



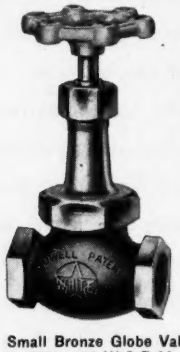
Large Iron Body Bronze Mounted Gate Valve for 125 pounds W. S. P. Made in sizes 2" to 30", incl. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Taper wedge double discs can be provided in sizes 2" to 12", incl. Seat rings and stem are bronze. Disc is bronze in 3½" and smaller size valves and bronze faced in the larger sizes. Also available in All Iron for certain services.



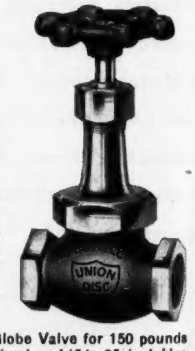
Class 1500-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc. Equipped with top-mounted electric motor operator for quick, positive opening and closing by remote control.



Class 300-pound Cast Steel Gate Valve. Has welding ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.



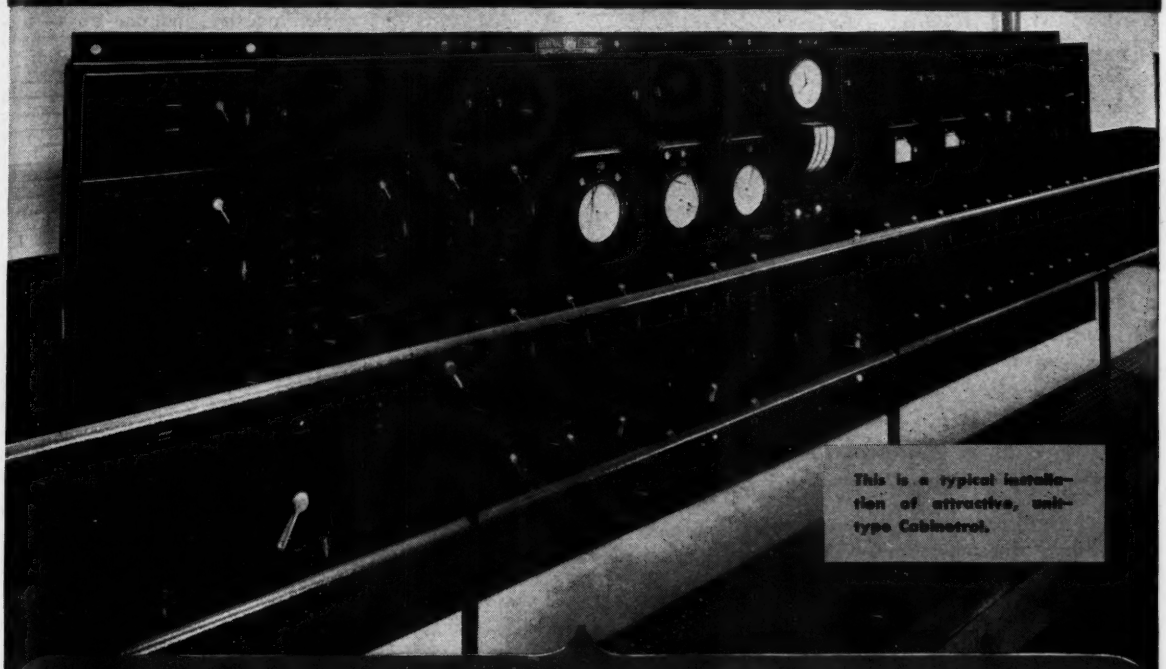
Small Bronze Globe Valve for 200 pounds W. S. P. Made in sizes ¼" to 3", incl. Has screwed ends, union bonnet, renewable, specially heat-treated stainless steel seat and regrindable, renewable, wear - resisting "Powellium" nickel-bronze disc. A long-life valve, designed to stand up under severe service conditions.



Small Bronze Globe Valve for 150 pounds W. S. P. Made in sizes ½" to 3", incl. Has screwed ends, union bonnet. Regularly furnished with renewable vulcanized composition disc for steam service but special discs are available for other services.

POWELL VALVES

HODGE-PODGE CONTROL IS EXPENSIVE!



This is a typical installation of attractive, unit-type Cabinetrol.

Trim, Modern CABINETROL Cuts Installation Time and Cost

Rambling, space-taking racks are a thing of the past. Control in the *modern* plant is compact, centralized G-E Cabinetrol. It's attractive in design, safe to operate, and it costs no more!

Cabinetrol saves installation time and expense because it's a single, self-supporting unit. No cumbersome frames—no cluttered walls. Just one attractive, all-metal unit that will greatly enhance the appearance of your mill.

The savings in installation cost that you get with Cabinetrol usually far outweigh its higher original cost. Only two operations are necessary—placing the unit in the designated location and connecting external power, motor, and control leads.

IT'S PRE-ENGINEERED

Cabinetrol is based on the use of standard enclosures equipped with the right combination of standard control devices. Each unit is pre-engineered to meet your specific requirements. All starters and accessory equipment necessary to your application are incorporated in the Cabinetrol unit before it is shipped.

PROTECTS YOUR OPERATORS

Because metal-enclosed Cabinetrol is completely deadfront, it offers your operators and servicemen maximum protection. Each motor control is installed in an individual sheet-steel compartment with an interlocking door. Operating mechanisms for motor-circuit switches and air circuit-breakers are available from the front of the panel.

LET US HELP YOU equip your plant with co-ordinated control. We'll be glad to work with you now—to provide a Cabinetrol system specially engineered for your plant—and, if you desire, to help you fit Cabinetrol into your over-all plans.

If you'd like more facts about Cabinetrol ask for Bulletin GEA-3856. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E INDUSTRIAL CONTROL

GENERAL ELECTRIC

Nothing Slips by the..

HENSZEY FLOW INDICATOR

This accurate instrument goes into action as soon as the first fluid starts to pass through. It registers any rate of flow from zero to 100 per cent — instantly and accurately — as it occurs.

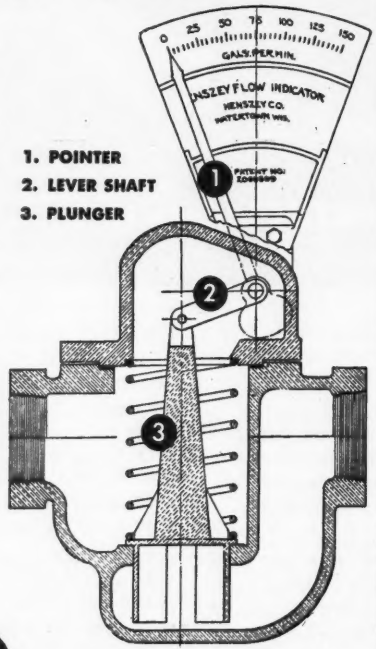
If your manufacturing process demands an accurate check on the rate of flow of liquids such as boiler feed water, condensate, gasoline, light oils, free-running chemicals etc. — plan now to investigate the Henszey Flow Indicator.

Send for special bulletin FI-1.

HENSZEY COMPANY, Dept. C-7, Watertown, Wis.

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct — without constants. The entire instrument can be installed right in the pipe line.



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FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

Obituaries

Rudolph Louis Suhl

RUDOLPH LOUIS SUHL, Manager of the Nickel Sales Department of the International Nickel Co. at New York, and an outstanding personality in the nickel industry and one of its pioneers, died suddenly on Monday morning, June 10, at his home, Plainfield, N. J., in his 64th year.

Mr. Suhl had been associated with International Nickel for over 43 years and at the time of his death was seventh in seniority of the U. S. Chapter of that company's Quarter Century Club. He joined the company's Orford Works in Bayonne, New Jersey, on May 1, 1903, serving in the Chemical Laboratory and later became Superintendent of the Calcining Department at that Works. When the Development and Research Division of the International Nickel Co. was formed in New York in 1922, Mr. Suhl was one of the original staff. After serving with this division for some years, Mr. Suhl became Assistant Manager of the Nickel Sales Department in 1929. He was made manager of the Nickel Sales Department in 1932.

During World War II Mr. Suhl was a member of the Ferrous Alloys and Minerals Priority Committee of the Office of Production Management and as such was active in assisting that office and later the War Production Board in the war-time problems involving metals. He was a member of the American Institute of Mining and Metallurgical Engineers, and the American Iron and Steel Institute.

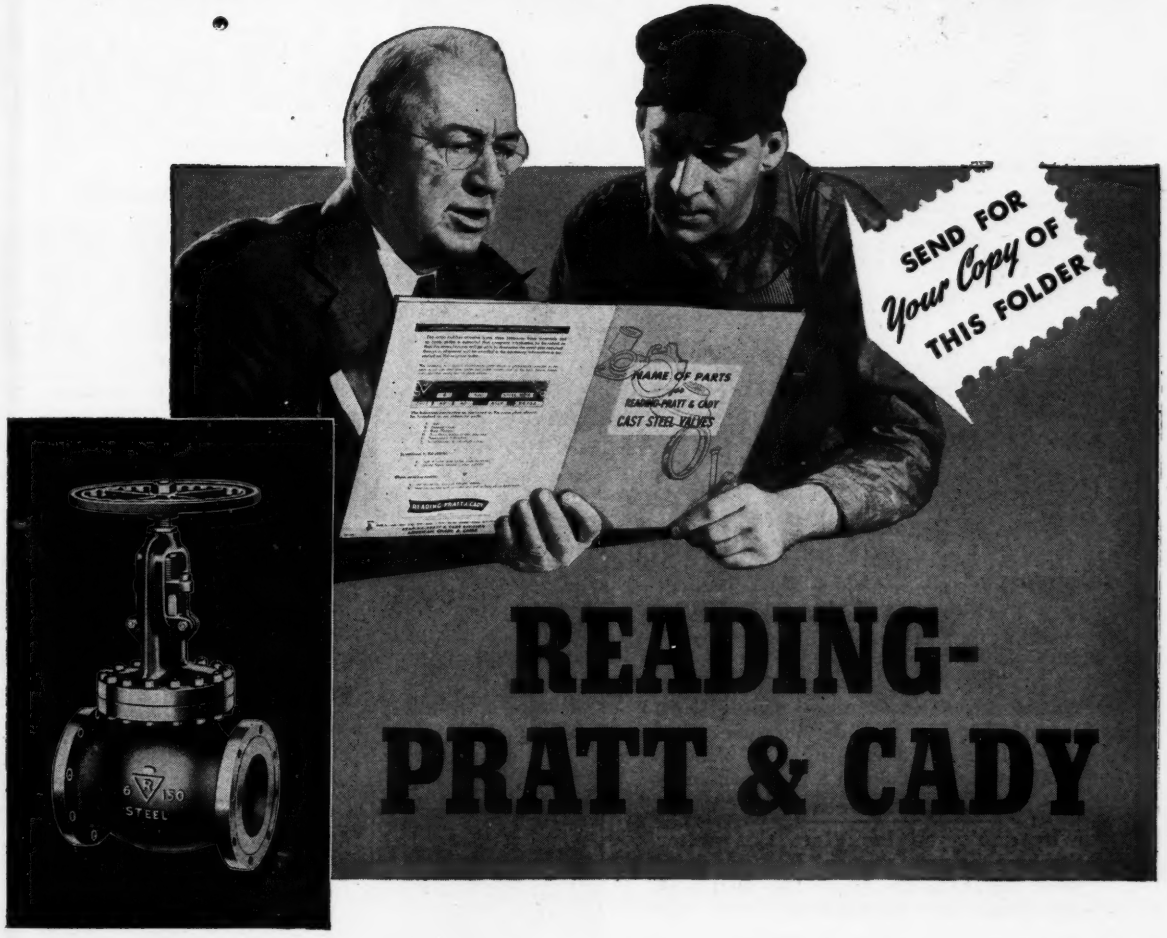
He is survived by his wife, the former Marguerite Manning; a daughter, Mrs. A. E. Cassot of Collingswood, N. J.; a son, Rudolph L. Suhl, Jr., Plainfield; two sisters, Mrs. Frank Weitenkamps, New York and Mrs. Charles Burrows, Bayonne, N. J.; two brothers, Charles H. Suhl, Plainfield, and John R. Suhl, Belmar, N. J., and two grandchildren, Rudolph L. Suhl, 3rd, and Arthur Lee Cassot.

Alfred Sherman Davis

A. S. DAVIS, head of the Mechanical Engineering Department of the Engineering Div. of New England Power Service Co., died at his home recently. He was 64 years of age.

Mr. Davis received his BS degree in electrical engineering at Tufts College in 1908 and worked for the J. G. White organization for a number of years. In 1915 he went to work for the New Haven Railroad and subsidiaries as construction and operating engineer in charge of power plant operations. Here he remained for four years, leaving in 1919 to join Stone & Webster where he was connected with construction of the Hartford Electric Lighting Co.'s Meadow Station. After the completion of the work at Hartford he undertook an assignment for the United Electric Railways Co. to improve and develop the Manchester Street power station, later becoming superintendent of pow-

This Simplifies Ordering STEEL VALVES and PARTS



This six-page, file-size folder contains much useful information in convenient form. Here are the standard names of all component parts of steel gate, globe and check valves. Cut-away pictures make it a very simple matter to identify each part. Send for your copy.

Reading-Pratt & Cady distributors are located in principal cities.

Reading Cast Steel Valves and Fittings • Pratt & Cady Brass and Iron Valves
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READING-PRATT & CADY DIVISION
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TRADE MARK

We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Cadmium plated for protection against corrosion and for better appearance.

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-201

YARNALL-WARING COMPANY
114 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

er and lines for this company.

He became associated more closely with the New England Power Service Co. when he was transferred to the Boston office of the company in 1935. Since that time, aside from handling mechanical engineering problems in general, he has specialized on steam power plant design and development.

Mr. Davis was a member of the American Society of Mechanical Engineers, the Prime Movers Committee of the Edison Electric Institute and the Providence Engineering Society.

He is survived by his wife, Elizabeth W.; two daughters, Kathleen M. and Ruth L.; and a son, A. Sherman, Jr., who is a construction engineer for Combustion Engineering Co., Inc.

Charles G. Schultz

CHARLES G. SCHULTZ who spent twenty years as a service engineer for Combustion Engineering Co., died recently. Mr. Schultz was considered an authority on multiple retort stokers.

Born in Johnstown, Pa., 62 years ago, his first connection was with Taylor Stoker Co., now American Engineering Co. of Philadelphia. In 1924 he went with Combustion Engineering and soon became district service manager of the Baltimore, Md., area where he was well known for his work at Westport and Gould St. Stations of Consolidated Gas, Electric Light and Power Co. Later he was sent on an important assignment in Australia. His last years were spent in Philadelphia district.

MANUFACTURERS' *News*

Changes at Corning Glass

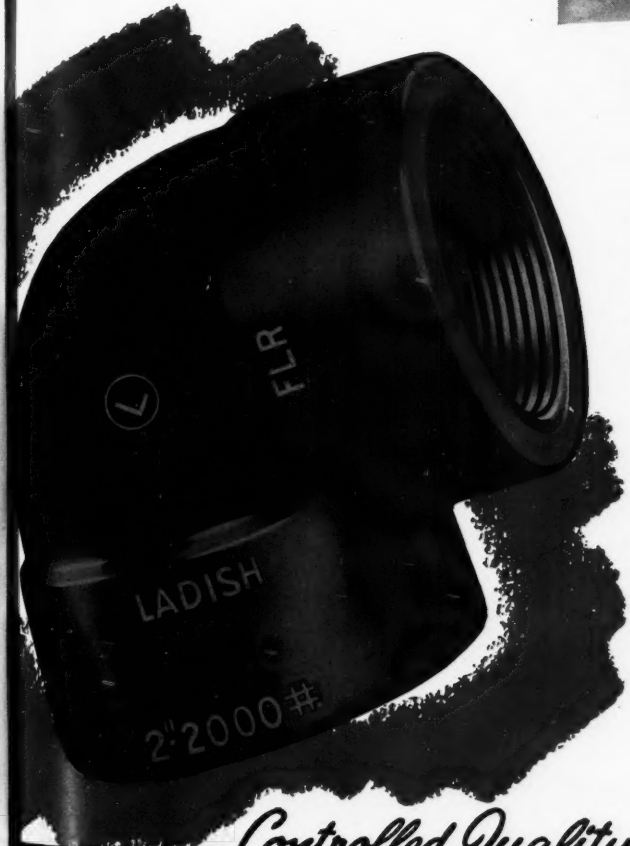
CORNING GLASS WORKS, recently announced important changes in the executive staff of the company. The appointments were made because of the company's expanding interests, it was emphasized, and do not indicate any change in management or policy.

William C. Decker, vice president, was elected president, succeeding Glen W. Cole, who was made vice chairman of the Board of Directors. Charles D. LaFollette was named treasurer, and will continue in his present position as vice president and director of sales. Eugene W. Ritter, vice president, together with Messrs. Decker and LaFollette, were added to the Board. John L. Ward, formerly treasurer, was made manager of the Bulb and Tubing Division of the company.

Dr. Eugene C. Sullivan, formerly vice chairman of the board and director of research, was elected honorary vice chairman. Dr. Jesse T. Littleton, vice president and associate director of research, was designated director of research.

In recognition of the company's diversity of operations, it was explained, the directors named an executive committee of seven, all of whom are active operating officials as well as directors of the company. Mr. Houghton will serve as chairman

What Does a Fitting Cost... IF IT FAILS?



Lost Production Time, Expensive Repairs Minimized by LADISH

FORGED STEEL FITTINGS

The *greatest* cost of a fitting is the loss in production time that results when it fails. That is why it is sound economics to install Ladish Forged Steel Fittings. Their increased dynamic strength and ability to withstand repeated shocks, strains and stresses are a direct result of advanced forging methods and superior metallurgical controls.

Ladish controlled quality Forged Steel Fittings are your assurance of economical trouble-free operation . . . and higher profits!

Write for your Ladish Forged Steel Fittings Catalog, Vol. II.

Controlled Quality

FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • BUFFALO • PITTSBURGH • CLEVELAND • CHICAGO • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES

TO MARK PROGRESS

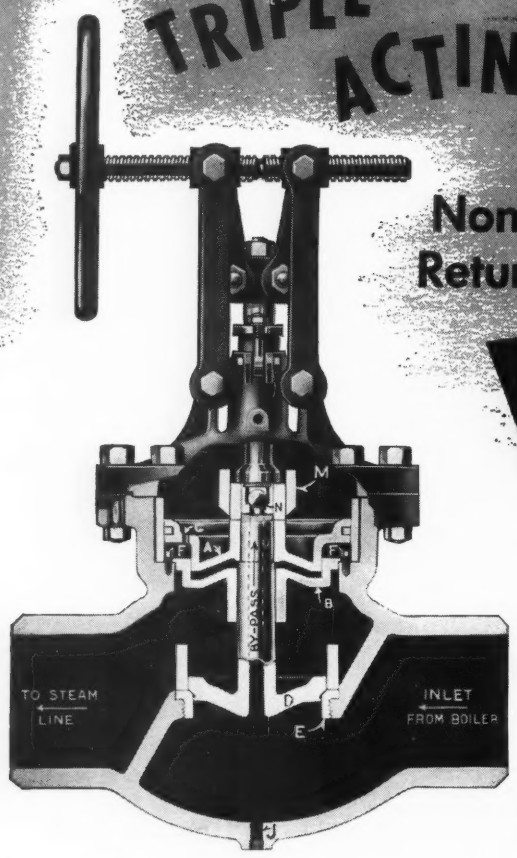
GOLDEN-ANDERSON

TRIPLE ACTING Non-Return VALVES

1 Will automatically cut in a boiler when its pressure equals line-header pressure.

2 Will automatically isolate a boiler whenever its pressure, from any cause, is lower than line-header pressure.

3 Will prevent steam flow from boiler in event of sudden drop in line-header pressure below the boiler pressure.



for

Engineered Protection

For maximum flexibility, safety and precision accuracy, put Golden-Anderson Triple Acting Valves in your boiler room.

- Prevents banging, chatter or spinning under any flow condition.
- All moving parts are in constant, perfect alignment.
- Built double extra heavy to prevent distortion or warping under pipe line stress and strain.
- Unfailing automatic operation for absolute safety.
- Available in bronze, monel, stainless steel or Gavalloy.
- Angle, Globe or Elbow patterns; sizes 2½" to 12" and larger sizes in the Cross pattern.

Let

GOLDEN-ANDERSON

Engineers

Work with you now, on any new or replacement problem involving high pressure flow control. Write for descriptive, technical catalog.

write for descriptive technical catalog

GA

GOLDEN-ANDERSON

VALVE Specialty Company

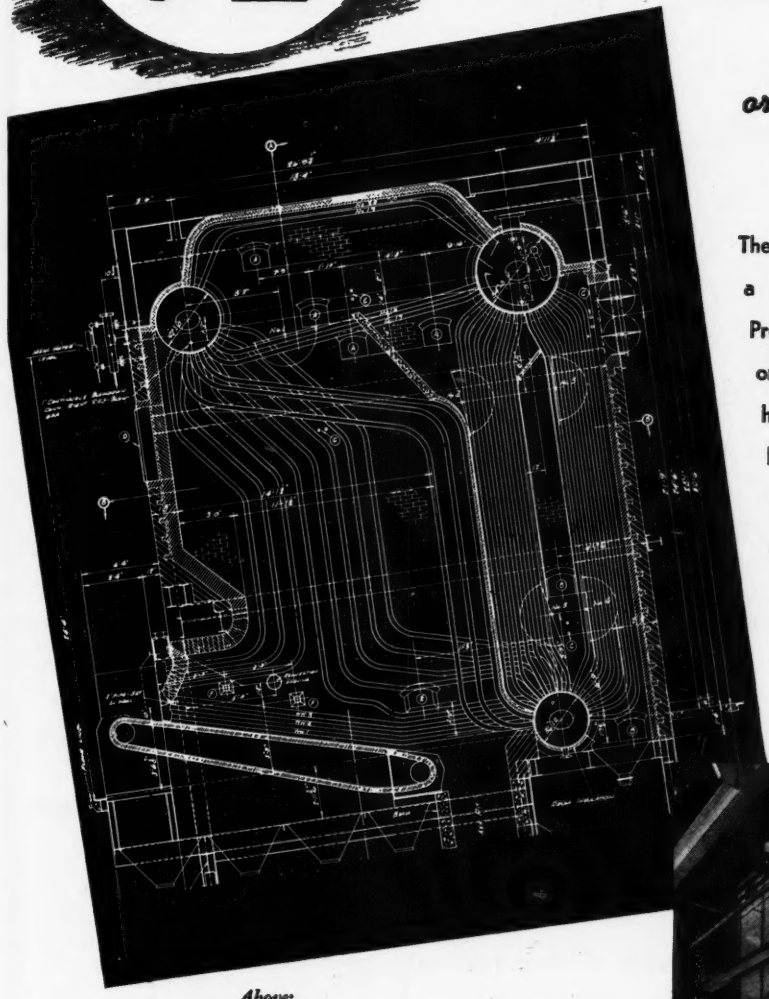
KEENAN BUILDING, PITTSBURGH 22, PA.

CLASS **VL**

Vogt Steam Generating Units

for POWER *or* PROCESSING LOADS, *and* HEATING

The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.



Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

Years Mean Nothing to DARTS

2 BRONZE SEATS GROUND TO A TRUE BALL JOINT MAKE THEM LAST AND LAST!

Darts don't die in a single service. Because of their two bronze seats, which are ground to form a true ball joint, they uncouple as easily as they close—may be used over and over again. Body and nut of high-test air-refined malleable iron are practically indestructible. Thus, in the long run, Darts cost least.

Ask your supplier to demonstrate Darts.

DART UNIONS

E. M. DART MANUFACTURING COMPANY, PROVIDENCE 5, R. I.

of the committee, which will include Dr. Sullivan, George D. Macbeth, vice president and controller, and Messrs. Cole, Decker, LaFollette and Ritter. William H. Curtiss, vice president, will serve as secretary of the committee.

BCR Appoints Research Engineer

BITUMINOUS COAL RESEARCH, INC., recently announced the appointment of William S. Major of Philadelphia, Pa., as development engineer for the national research agency of the bituminous coal industry. Well known in the power field after 20 years of service with American Engineering Co. Mr. Major will be responsible for promoting various BCR research projects that have progressed far enough to justify commercial trial or use.

The new development engineer will deal at first largely with industrial and commercial equipment designed to provide improved utilization of bituminous coal. One of his immediate duties will be to promote wider use of BCR-designed overfire air jets as smoke-prevention devices, especially in the stationary field.

New Representatives for Elgin in South

ELGIN SOFTENER CORP., Elgin, Ill., announces the appointment of two new southern representatives. Watson & Watson, with headquarters in Knoxville, Tenn., will cover Eastern Tennessee, North and South Carolina and the Western portion of Virginia. W. Harwell Allen, with headquarters in Nashville, Tennessee, will cover Western Tennessee, Northern Mississippi and Northern Alabama.

These representatives are prepared to analyze water samples, make surveys and to prepare complete water conditioning recommendations. The products handled by them include the water softeners and filters, boiler water conditioning systems, water treating chemicals, chemical feeders and water testing equipment.

Cutler-Hammer Opens Rockford Office

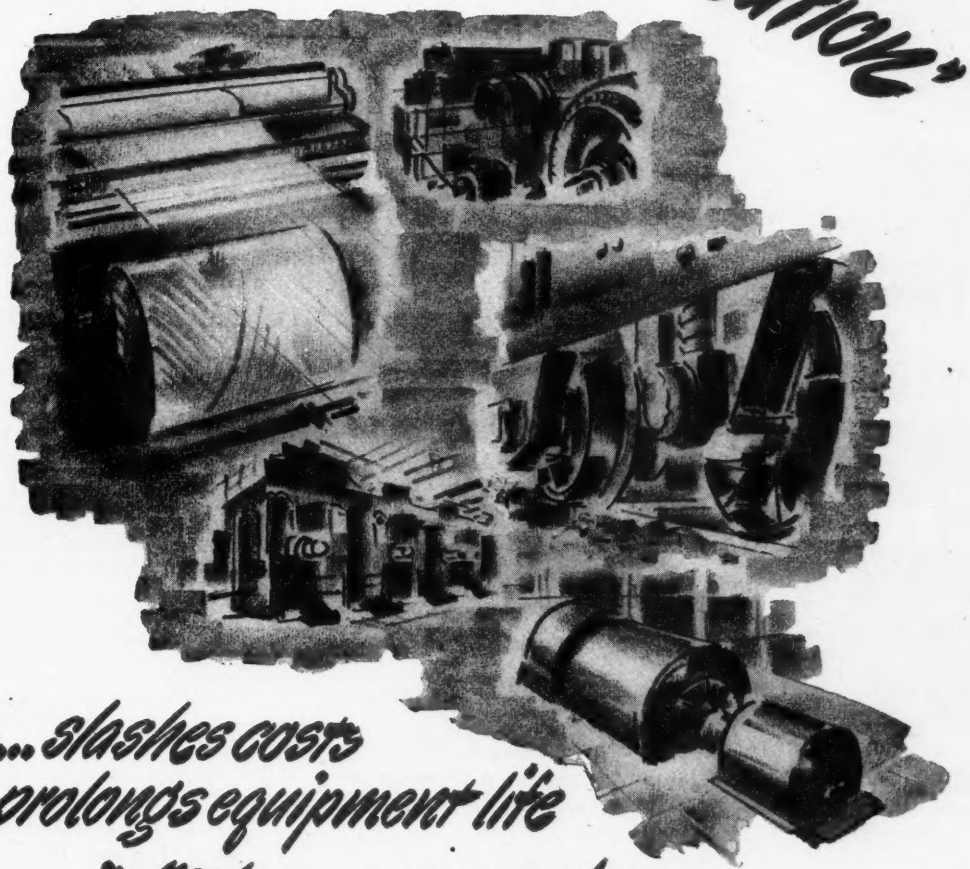
CUTLER-HAMMER, INC., announces the opening of a new office in Rockford, Illinois, in recognition of the already established position of Rockford as a metal and woodworking machine tool manufacturing center. The office will be located at 1404 North Main Street, telephone Blackhawk 5950. The office will be in charge of G. I. Wolff, who has handled the territory for 19 years. R. E. Ford, who has been in the Milwaukee sales organization for five years, will be resident sales engineer.

Kerotest Acquires Security Valve

THE SECURITY VALVE DIVISION of Security Engineering Co., Inc., Whittier, Calif., a member of Dresser Industries, Inc., has been acquired by the Kerotest Manufacturing Co., Pittsburgh valve manufacturer, according to a recent announcement.

A new manufacturing plant has been acquired at Slauson and Alcoa Avenues, Los Angeles, where the present line of Security cast and forged

Tycol "Engineered Lubrication"



...slashes costs
...prolongs equipment life
...reduces wear and repair

TYCOL DIESEL OIL— Minimizes sticking valves . . . reduces cylinder wear . . . cuts oil consumption.

TYCOL TURBINE OIL—Inhibits rust...resists sludging and emulsification.

TYCOL STEAM CYLINDER OIL—Assures economical lubrication at all temperatures . . . supplies superior protection . . . provides longer service.

TYCOL NO-RUST-OL—Protects against rust . . . usable at all temperatures . . . is readily removed in degreasing operations.

TYCOL EXTREME PRESSURE LUBRICANTS—Extremely stable . . . high film strength . . . non-corrosive . . . water resistant.

There's a Tide Water Associated lubricant for every service condition. For aid in the solution of your lubrication problems, get in touch with your nearest Tide Water Associated office today.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia

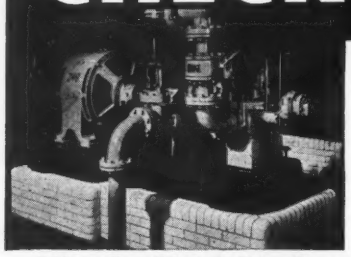
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE - NEW YORK 4, N. Y.

THIS NEW INFORMATIVE CATALOG WILL SOLVE YOUR "WATER HAMMER" *Problem!*

WILLIAMS-HAGER

FLANGED *Silent*

CHECK VALVES



A Williams-Hager Valve in the Metropolitan Life Building, New York.

- *Precision Engineered*
- *Economical*
- *Efficient*
- *Frictionless*
- *Tight Under Every Operating Condition or Pressure up to 6000 Lbs.*

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provide uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, air, salt water, brine, etc., regardless of temperature.

Write today for YOUR copy!

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

3000 PENNSYLVANIA AVENUE • PITTSBURGH 12, PA.

steel valves and Kerotest valves will be produced for Pacific Coast and Western distribution.

At the same time, the formation of a new company was announced—The Kerotest Pacific Co. (to be operated as a subsidiary of the parent Pittsburgh company)—in order to more satisfactorily serve the customers of both Security Valve and Kerotest throughout the Western states.

The purchase included all of the present stocks, designs, goodwill, and equipment of the Security Valve Division.

Coaltoter Changes Name

THE NAME OF Coaltoter Conveyor Co., 310 S. Michigan Ave., Chicago, has been changed to Material Movement Industries. The name was changed to more accurately portray the breadth of the company's equipment and activities in the material-handling field.

Hewitt Changes Name

HEWITT RUBBER CORP. has changed its name to Hewitt-Robins, Inc., thereby bringing in the identity of its wholly-owned subsidiary, Robins Conveyors, Inc. The change was announced recently after it was approved by the stockholders in Buffalo April 30. All officers were reelected. Harold H. Von Thaden, 1st vice president of Robins Conveyors, was elected a director of Hewitt-Robins Incorporated.

The manufacture of foam rubber, molded rubber goods, conveyor belts, transmission belts and industrial hose in the company's Buffalo plants will continue as the Hewitt Rubber Division of the corporation. The engineering and manufacturing of conveyors and other materials handling systems at Passaic, N. J., will be known as the Robins Conveyors Division.

Cornell-Dubilier Purchases Building

WITH A VIEW to maintaining production at close to wartime levels, Cornell-Dubilier Electric Corp. purchased recently an eight-story building in Worcester, Mass., three floors of which it had leased for the duration of the war to produce the tiny condensors required for the proximity fuse. The company will also purchase the plant's machinery and equipment, most of which is owned by the Navy, at a price already agreed upon.

Link-Belt's New Sales Offices

LINK-BELT CO., Chicago, announces the opening of three new sales offices.

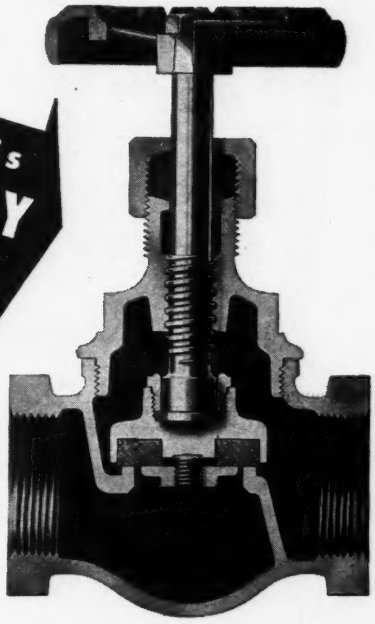
A new office at Moline, Ill., is located at 1608 Fifth Ave., with M. J. Parykaza, district sales engineer, in charge. Mr. Parykaza, who started his Link-Belt career in 1922 in the engineering department of the company's Pershing Road plant, Chicago, has in reality been serving customers in the Moline territory out of Chicago since 1944.

Cincinnati, Ohio's, new office is located at 730 Temple Bar Building,

Every feature you want in a

BRONZE GLOBE VALVE with renewable composition disc

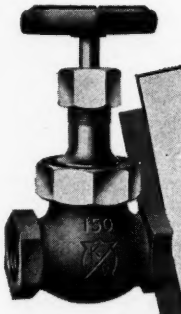
is in this KENNEDY DESIGN



Here is a renewable composition disc bronze globe valve with special features that make it an outstanding value . . . for its features give you extra conveniences, extra service, and extra maintenance savings at no extra cost.

For example, look at the disc . . . the heart of the valve. The disc holder is accurately guided in the body by four guide prongs which prevent tipping or binding, and its stem head recess has a milled bearing surface which permits it to swivel freely. When the stem is turned to wide open position, this slip-on disc holder becomes locked in place so it cannot fall off when the valve is taken apart, but a half-turn of the stem releases it for removal.

Then, too, notice the unusual height of the seat, which gives longer use of the disc before renewal. These are but a few of the extra values of this 150-lb. valve which is fully described in the 240-page Kennedy Catalog. Write for your copy today.



YOU WANT THESE VALVE FEATURES

. . . you'll find them in this KENNEDY design

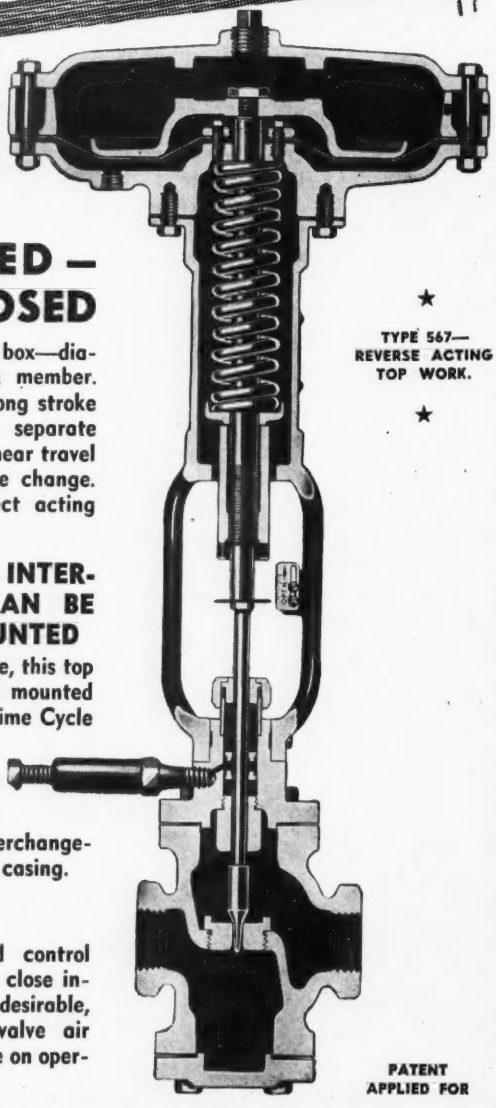
1. **Generous Strength . . .** Body and bonnet are of high-grade dense metal with ample thickness and rounded fillets. Stem has large diameter and extra large number of contact threads.
2. **Easy Operation . . .** Stem and stem contact surfaces are accurately threaded. Deep stuffing boxes permit tightness without undue pressure on packing. Large handwheel gives firm, comfortable grip.
3. **Lasting Tightness . . .** Discs and seats seat accurately, and their sturdy design resists distortion and has special provisions for take-up of wear.
4. **Long Life . . .** Many Kennedy valves have been in daily use a quarter century and more.
5. **Convenient Repacking . . .** Glands and packing are easily accessible.
6. **Economical Maintenance . . .** Long wear built into all parts, and adjustments or other attention are seldom required.

THE KENNEDY VALVE MFG. CO.
Elmira, New York

KV-113

KENNEDY *valves - pipe fittings - fire hydrants*

A NEW FISHER
DIAPHRAGM MOTOR FOR CONTROL VALVES



TYPE 567—REVERSE ACTING TOP WORK.

PATENT APPLIED FOR

REVERSE ACTING
AIR OPENED—SPRING CLOSED

FEATURES: No stuffing box—diaphragm acts as sealing member. Large diaphragm area. Long stroke action. Enclosed spring, separate from pressure chamber. Linear travel relationship to air pressure change. Interchangeable with direct acting Type T Top.

BOTH WIZARD OR INTERMITTER PILOTS CAN BE INTEGRALLY MOUNTED

For field and general service, this top work allows integrally top mounted Wizard Pressure Pilot or Time Cycle Intermitter to be mounted directly on valve. Pilot diaphragm casing assemblies of integrally mounted unit interchangeable with upper diaphragm casing.

APPLICATION

For pneumatic operated control valves where push down to close inner valve construction is desirable, yet operation requires valve air opened, spring closed—close on operating medium failure.

Write for specifications

FISHER GOVERNOR COMPANY

1033 FISHER BUILDING — MARSHALLTOWN, IOWA

Main & Court Sts., Cincinnati 2, with L. R. Clark, district sales engineer, in charge. Mr. Clark started his Link-Belt career in 1927 at the company's Dodge plant in Indianapolis and has been serving customers in the Cincinnati territory out of Indianapolis since 1938.

A new office at Birmingham, Ala., is located at 823 Comer Building, 2100 Second Ave., N., Birmingham 3, with C. C. Wiley, district sales engineer, in charge. Mr. Wiley started at the company's Philadelphia plant in 1926 and has for the last 17 years been a part of the Link-Belt sales organization in Pittsburgh, where he specialized on serving steel mills.

Sterling Engine Moves Office

EFFECTIVE May 1st, the New York office of Sterling Engine Co., formerly located at 900 Chrysler Building, has been removed to 401 Fourth Ave., New York 16, N. Y.

In its new quarters the Sterling Engine Co. will have a large showroom facing Fourth Ave. wherein will be exhibited Sterling marine and industrial engines.

MANUFACTURERS' *Personals*

Announcement has been made by Fairbanks, Morse & Co., that L. W. Stolte has been elected to the position of Secretary of the company, to replace Fred C. Dierks, recently retired after a long service of 45 years.

Farris Engineering Co. of Palisades Park, N. J., announces that Detroit representative, Du-Bois-Webb Co., has recently added Howard Kalbfleisch to its sales engineering staff. Mr. Kalbfleisch will assist in the engineering sales and service of Farris safety and relief valves in the Michigan territory.

Robins Conveyors, Inc., announces the retirement of C. C. Brooks, who was Western Manager of the Hoisting Machinery Division, with his headquarters in the Chicago office of the company.

The De Laval Steam Turbine Co., Trenton, N. J., announces the appointment of James P. Stewart as special representative for centrifugal blowers and compressors. Mr. Stewart, who for many years was connected with the Elliott Co., was recently the Assistant General Manager of B-W Superchargers, Inc., Milwaukee, Division of the Borg-Warner Corp. Mr. Stewart will make his headquarters in Trenton.

The Dampney Co. of America, Hyde Park (Boston 36), Mass., announces the appointment to its sales staff of Kenneth E. Greene, assigned to the company's Chicago office, 53 West Jackson Boulevard, and of William T. Campbell, to the Philadelphia office, located in the Bourse Building.

Fairbanks, Morse & Co. announces the assignment of Perry G. Jefferson as Traffic Manager of the company, to replace Joseph W. Elliott, who recently retired from this position after

WICKES

3-DRUM WATER TUBE BOILERS

Wickes 3-Drum Water Tube Boilers are especially designed for quick production of maximum steam at all ratings. Rapid steaming is assured by fast, unrestricted water circulation. Products of combustion travel through long, properly baffled passages which provide maximum scrubbing contact with water heating surface. Proper tube arrangement assures more effective absorption of radiated heat from the furnace. Entire installation readily accessible for inspection and maintenance. Write for complete information on how Wickes 3-Drum Water Tube boilers will insure faster, more efficient power generation in your plant.

SALES OFFICES: Detroit, Mich.; Chicago, Ill.; New York City; Milwaukee, Wis.; Pittsburgh, Pa.; San Jose, Calif.; Tulsa, Okla.; Fort Worth, Texas; Portland, Ore.; Saginaw, Mich.; Mexico City, Mexico, Boston, Mass.; Indianapolis, Ind.; Baltimore, Md.; San Francisco, Cal.

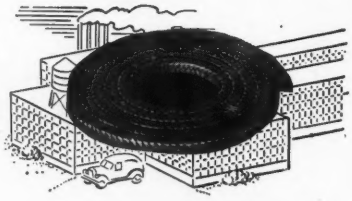
THE WICKES BOILER COMPANY, SAGINAW, MICHIGAN

WOULD ONE OF THESE *Packings* END ONE OF YOUR PACKING PROBLEMS?

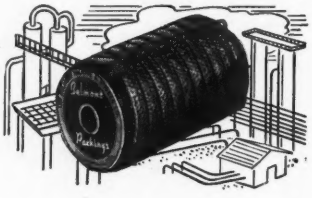
As examples of the extra service you get from Belmont Packings, here are three packings built with special features to give you better sealing and longer life. And for *any* steam, water, oil, gas, air, acid, alkali or ammonia service . . . tell your distributor: "Belmont".

Extra sensitive to gland pressure. Belmont 2 Diagonal Wedge Expansion Packing has sliding rubber and duck diagonal wedges incased on three sides with rubber and duck channel. For reciprocating rods and plungers (especially when worn) working against hot and cold water, steam up to 340°F., ammonia.

For rotating shafts. Every strand of asbestos yarn in Belmont 754-P Centrifugal and Rotary Pump Packing is thoroughly lubricated and graphited, resulting in a packing that will keep pliable for long, economical service.



For gasoline and other petroleum distillates. Belmont 6100 is made of a high-grade asbestos yarn, firmly braided, each strand thoroughly impregnated with a special compound to retain softness and essential sealing qualities when applied against volatile distillates.



There is a Belmont Packing for Every Service

Belmont distributors are located in every large industrial center, ready to give you prompt delivery from local stocks.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

IN THE BLUE-AND-ORANGE BOX

6 New Folders
Write us for new folders on Belmont Centrifugal and Rotary Pump Packings, Flax Packings, Hollow Center Packings, Oil and Gasoline Packings, Rod Packings, Sheet Packings.

THE BELMONT PACKING AND RUBBER CO.

Butler and Sepviva Streets

Philadelphia 37, Pa.

twenty-three years' service. Mr. Jefferson has had wide experience in railroad activities as he joined the Canadian Pacific Railroad in Cincinnati in 1924 as chief clerk. From 1925 to 1929 he served as assistant cruise director on various Canadian Pacific cruises traveling to the West Indies, South America, Africa, Europe, the Mediterranean and the Far East.

Appointment of David FitzGerald as manager of employee relations for the plastics divisions of the General Electric Co. was announced recently. Mr. FitzGerald will be responsible for coordination of employment and rates, and will represent the divisions on all matters pertaining to collective bargaining agreements.

Harold L. Aldrich has been appointed district representative in the New York office of the General Electric Chemical Department, according to a recent announcement. In his new position Mr. Aldrich will be G-E sales representative for Glyptal alkyd resins.

Scovill Manufacturing Co., Waterbury, Conn., recently announced the appointment of G. K. Thornton as advertising manager. Mr. Thornton comes to his post with an extensive background of advertising and sales work. Soon after graduating from Weslyan University in 1929, he entered the employ of Manning, Bowman & Co., the electrical appliance manufacturer. In 1933, he was named to the post of sales promotion manager.

George P. Lehmann has been appointed to the newly created post of assistant manager of the General Electric Plastics Divisions it was announced recently. A former colonel in the 12th Air Force Service Command, Mr. Lehmann has been staff assistant to the manager of the Plastics Divisions since his return from service last fall. He was previously assistant to the chief engineer of the Plastics Divisions and also served as plant engineer at the G-E Meriden, Conn., plant.

Simplex Valve & Meter Co. announces that its Detroit office, DuBois-Webb Co., has recently added Howard Kalbfleisch to the staff of sales engineers who handle Simplex products in the Michigan area. Mr. Kalbfleisch, recently discharged from the U.S.N.R. where he served as Lt.-Commander, Ordnance section, is a graduate of Michigan State College and is well known in the industrial instrument field.

Universal Lubricating Systems, Inc., announces the election of Austin L. Staley as president, and William P. Farrell, as vice-president.

Benjamin O'Shea has retired as Chairman of the Board of Directors of Union Carbide and Carbon Corp. He will continue as a Director and a member of the Executive Committee. The office of Chairman of the Board has been abolished with Mr. O'Shea's retirement. At an organization meeting of the Board of Directors Fred H. Haggerson was re-elected President of Union Carbide and Carbon Corp., and all other officers were re-elected.

D. F. Roloff, H. K. Pritchard, and C. Stonehill have been named to major sales positions in the newly-created Specialty Transformer Division

SKYROCKETED *to oblivion*

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000

This Valve DID THE TRICK

OUT they go on a one way ride that takes these "cost boosters and trouble makers" to a quick ending. There wasn't a chance for them because they were up against *streamline valve* performance. The same thing happens every time in every plant that installs the CASH STANDARD "type 1000" Pressure Reducing Valve.

You can find out the complete details on the "type 1000" by sending for Bulletin 962. See why the straight line flow ends the costs and losses that come with poor valve performance.

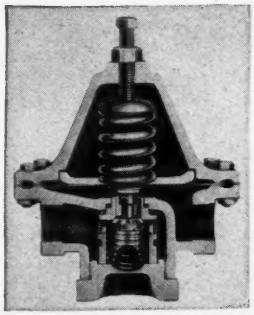
Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs

CASH STANDARD CONTROLS.. VALVES

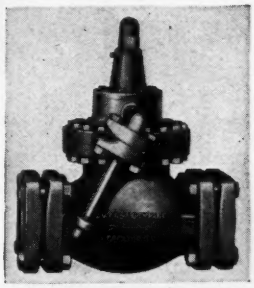
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

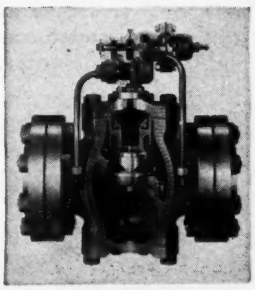
Send for them



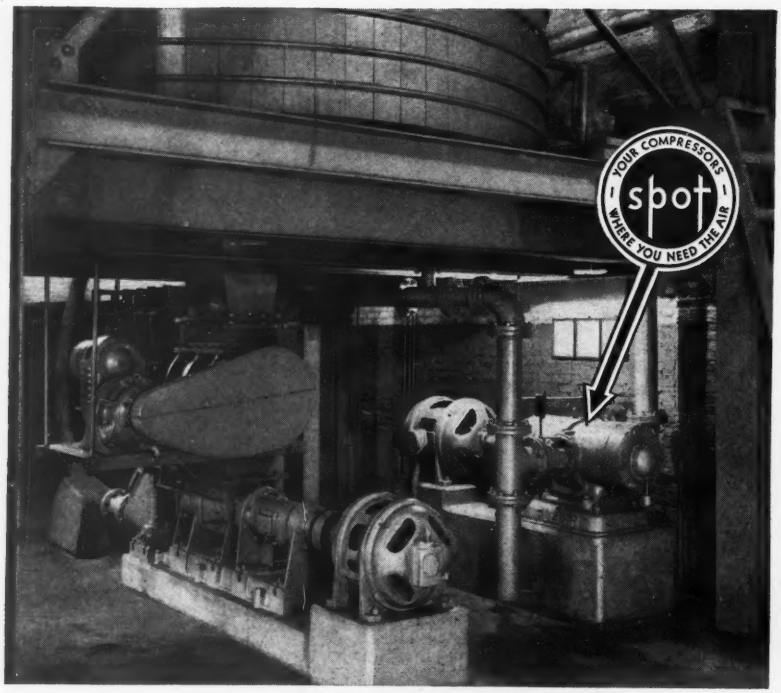
Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.



Another Fuller Rotary . . . "spotted" where they need the air

This Fuller Rotary Single-stage Compressor was installed by a producer of pulverized phosphate rock to supply air to the Fuller-Kinyon Pump for conveying material to a mixer bin.

Compressed air was available from a central compressor station but at a very much higher pressure than needed for this particular purpose. So rather than use air through a reducing valve with the attendant losses, it was decided to install a compressor to discharge directly to the pump. By this means the compressor develops the exact pressure required by the system, assuring maximum efficiency at all pumping conditions. This results in considerable saving in power, costly transmission lines with their attendant expense, friction losses and line leakage. In other words, a compressor "spotted" for air where and when needed and at pressures to do the work most economically and efficiently.

Write for Bulletin C-5, illustrating and describing Fuller Rotaries.

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C-117

FULLER

PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

of the General Electric Co., according to an announcement by the Division Manager. Mr. Roloff, formerly Assistant Manager Sales of the old Specialty Transformer Section, has been appointed Assistant Manager of the new Division. Mr. Pritchard and Mr. Stonehill have been named Manager Sales, respectively, of General Purpose Components Section and the Lighting Components Section. All three men have had long association with the specialty transformer business.

R. M. Wilson, Jr., has joined the Technical Service Section of the Development and Research Division of the International Nickel Co., Inc., at New York, as a Welding Engineer. He was formerly Welding Engineer at the Bloomfield, N. J., Works of the General Electric Co., and graduated from Cornell University in 1932 with a degree of Mechanical Engineer. Mr. Wilson is Chairman of the New Jersey Section of the American Welding Society.

Establishment of a School of Engineering at the University of Buffalo and the appointment of Prof. Paul E. Mohn as its dean, was announced recently. The new school will be housed in the engineering building now under construction on the North Main Street campus. The building is expected to be completed by October. A campaign for funds for the construction and equipment of the building, is now in progress.

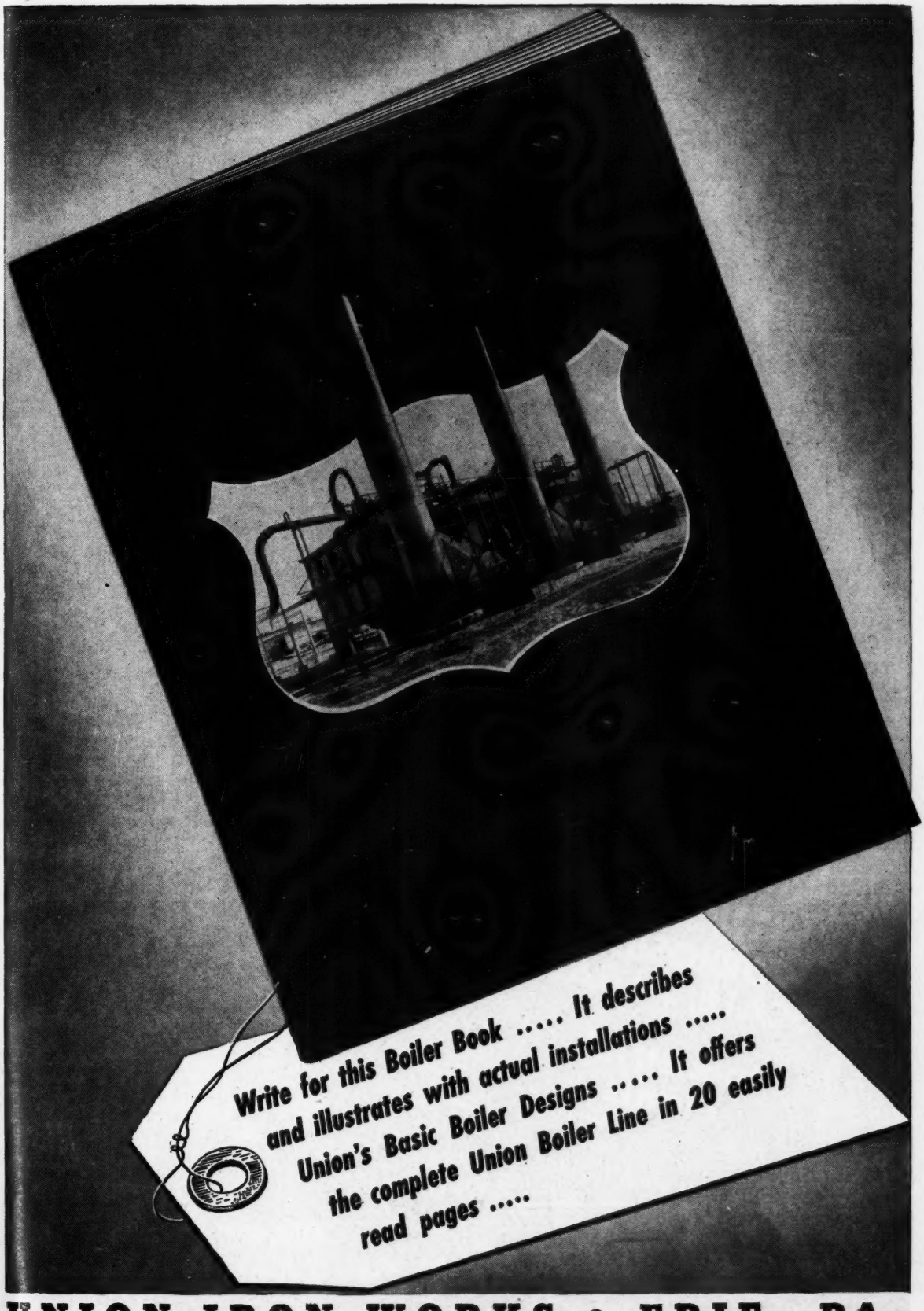
Ampco Metal, Inc., has announced the appointment of R. S. Stover, as supervisor, Philadelphia - Washington District with headquarters in Philadelphia at the Wilfred Building. Mr. Stover previously had been district manager of Ampco's Washington, D. C. Office.

Appointment of The Republic Supply Co. of California as distributor of Manhattan industrial rubber products, has been announced by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. Republic Supply will be under the supervision of A. R. Bradshaw, Manhattan's Pacific Slope Manager at San Francisco, and R. G. Hueman, Manhattan factory representative, will make his headquarters at Republic and will be available to lend his assistance in solving mechanical rubber goods problems.

S. M. Spears, Jr. has been promoted to assistant district manager of the New York office of Tube Turns, Inc., Louisville, Ky., it was announced recently.

Appointment of William A. Hoschler as manager of district stores of the West Central District of the Westinghouse Electric Supply Co. has been announced by L. A. Pixley, district manager. His headquarters will be in Columbus, Ohio. At the same time, Robert B. Burwell was named purchasing agent for the district.

L. E. Lynde has been appointed manager of the New England District of the Westinghouse Electric Corp., with headquarters at Boston, Mass., according to a recent announcement. At the same time, it was announced that F. L. Nason, who has been New England district manager, will become a special representative of the company in the New England district. He will handle special and important assignments with large purchasers.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New ENGINEERING BOOKS

Electric Motors and Generators, by E. S. Lincoln; First Edition; 384 pages; 5½ by 8¼ inches; illustrated; cloth; published by Essential Books, 270 Madison Ave., New York, N. Y.; 1945. Price $3.00.

This book covers information on direct and alternating current motors of all kinds. Tables show complete standardization of motor manufacture and use; instructions for installation and operation of all types of motors and generators, and details of armature construction. It covers motor generator sets, fractional horsepower motors, charging generators for storage batteries, electro-plating generators, emergency engine generating sets, and torque motors. There is also a chapter dealing with the characteristics of mechanical drives, such as V-Belt Drives, gear drives, chain drives, variable speed transmission, speed reducers, couplings, clutches, bearings, etc. There is a particularly good chapter dealing with the inspection and maintenance of industrial electrical machinery and equipment. This chapter on maintenance contains a complete list of typical motor and generator faults and suggestions to find them and to remedy them. This book should be useful to every practical electrician.

Electrical Measuring Instruments, by E. S. Lincoln; First Edition; 284 pages, 5¾ by 8¾ inches; illustrated; cloth; published by Essential Books, 270 Madison Ave., New York, N. Y.; 1945. Price $3.00.

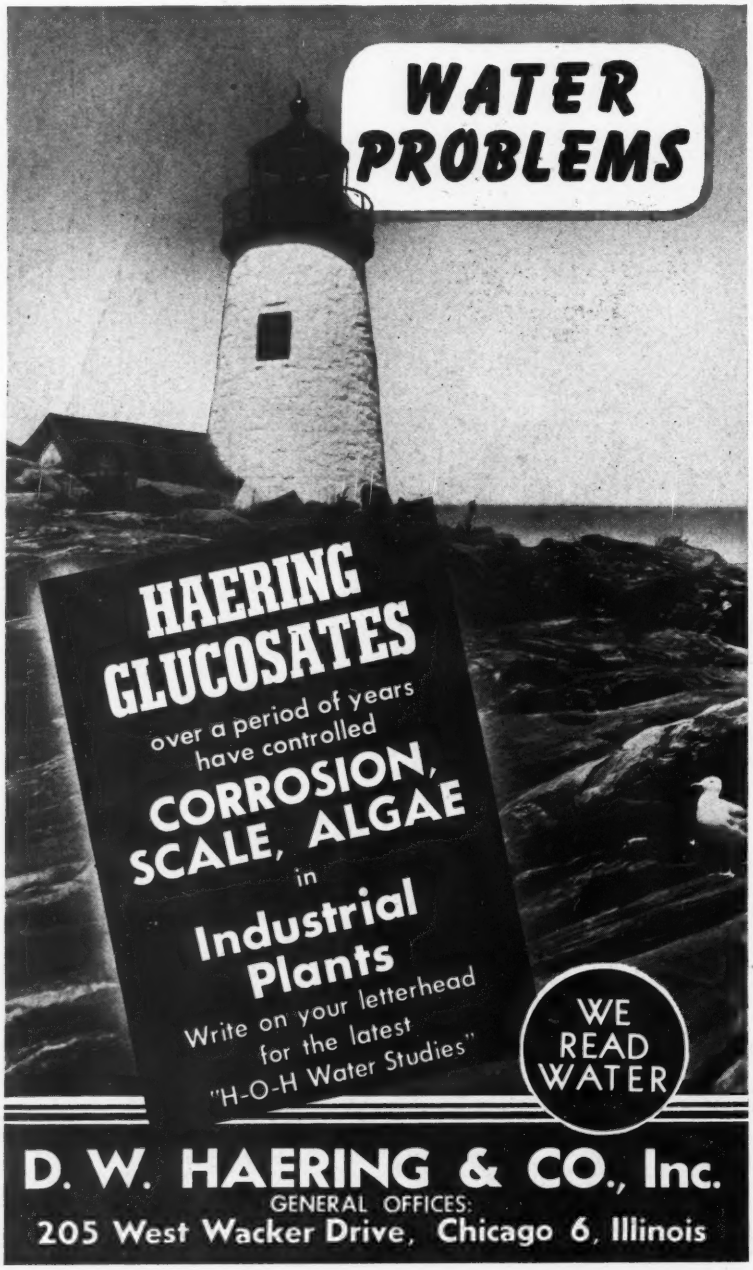
This book covers operating principles of all types of industrial electric measuring instruments, both portable and switchboard types, shunts, multipliers, current and potential transformers, etc. Details of ammeters, voltmeters, wattmeters, ohmmeters, power factor meters, speed indicators, etc., are given with tables for quick reference in selection of instruments. Indicating, integrating and graphic instruments are included for use on both d-c and a-c circuits. Other subjects covered are ranges, damping, scales, frequency, sensitivity, accuracy, etc. The book also includes data on instrument connections, power consumption of instruments, their use and care. Details are given for making electrical surveys of an entire system from which proper operation of equipment and economies may be made.

Industrial Electric Lamps and Lighting, by E. S. Lincoln; First Edition; 342 pages, 5¾ by 8¾ inches; illustrated; cloth; published by Essential Books, 270 Madison Ave., New York, N. Y.; 1945. Price $3.00.

This book completely covers every type of industrial lamp with detailed instructions for their use with proper reflectors for indoor and outdoor lighting. Emergency lighting and equipment are described as well as Bactericidal lamps, Black Light and Fluorescent materials. The book contains tables of lighting data together with calculations and charts for determining proper lighting under various conditions. Also included is a chapter dealing with industrial flash lights and portable lamps for industrial and other uses.

The Decimal Point and the Slide Rule, by W. P. Miller, an eight-page mimeographed folder, published by W. P. Miller, 536 "F" Street, San Diego 1, California, price $1.00.

This eight-page booklet discusses the location of the decimal point in the use of the slide rule and describes some time-saving short-cuts for electrical engineers and technicians. This booklet discusses such items as digit count, corrections in operating the slide rule, slide rule short-cuts, duplex rules, complex notation solutions, proper use of the A & B scales, methods of calculating inductance, capacity, frequency and reactance; and resonant frequency. The real purpose of the booklet is to encourage the reader to really get acquainted with his slide rule. Then he will find that it is often possible to devise short-cuts for everyday problems which will make the actual calculations almost automatic. Years of experience, says the author, have convinced him that a good slide rule can be used for about everything except to tell the time of day or to forecast the weather.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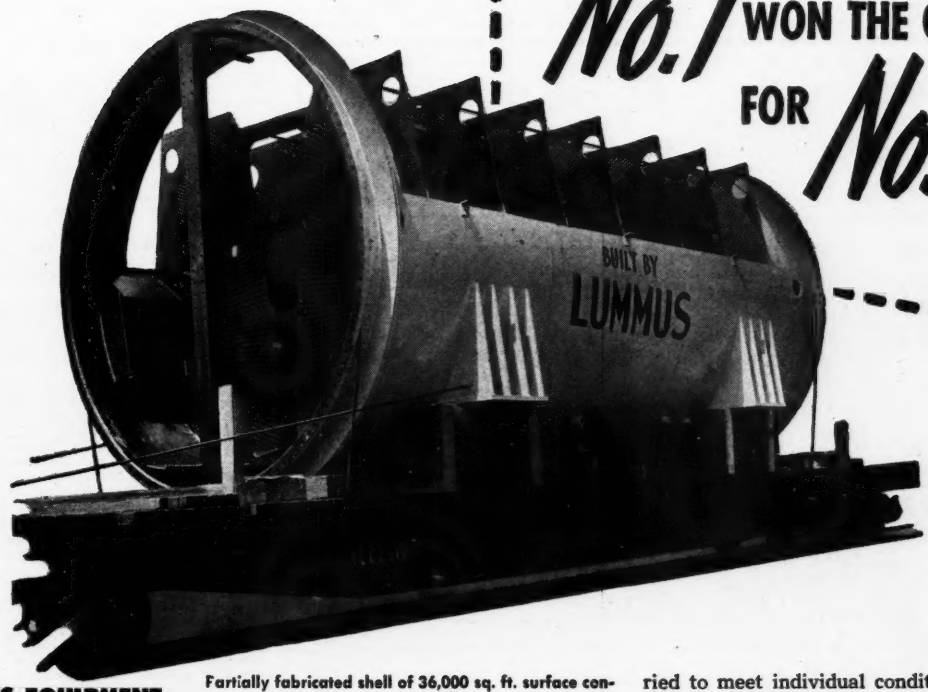

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(Continued from page 54)

PRIME MOVERS

55 **Wheel Turbines**—Explanation of 14 advantages; diagrammatic illustrations and explanations of operation; 8 pages. Terry Steam Turbine Co.

56 **Axial Flow Impulse Turbine**—Bulletin S-107; six types described; data for estimates; applications; types, casings; wheels and blades; shafts, nozzles and bearings; overspeed stop and other governor features; lubrication; 8 pages. Terry Steam Turbine Co.

57 **Multi-Stage Turbine**—Bulletin SR-114; Casing, lagging, wheels and blades; shafts, nozzles, bearings; governors; speed changer or synchronizer; governor valve and steam strainer; lubrication; general; 10 pages. The Terry Steam Turbine Co.

58 **Steam Engines**—Bulletin No. 306; Engineering data, tabular material descriptions; 8 pages. Troy Engine & Machine Co.

59 **Generating Sets**—Bulletin No. 108; General descriptions, typical installations, engineering data tables, details of construction, completely illustrated; 24 pages. Troy Engine & Machine Co.

STOKERS

60 **Stoker**—Catalog H; Type H stoker; cross-sectional installation drawing; features of ash discharge; typical installations; 10 pages. American Engineering Co.

61 **Air-Cooled Stoker**—Catalog R-A; features of construction; how timing device works; installation drawings, ash discharge, air cooling features; features of front end driving mechanism; engineering data tables; 20 pages. American Engineering Co.

62 **Water-Cooled Stoker**—Catalog W; drawings of installations; features; furnace views; 8 pages. American Engineering Co.

63 **Spreader Stoker**—Installation views; features of various parts; cross-sectional view of furnace with installation; listed features; 8 pages. American Engineering Co.

64 **Pneumatic Spreader Stoker**—Threefold booklet on the inner page of which there are 30 spirally-bound vertical pages which fold back to tell the story of the stoker, installation, features, construction, principles, engineering, types and models, typical installations; well illustrated; 33 pages. Iron Fireman Mfg. Co.

65 **Poweram Stoker**—Bulletin 7121; essentials of successful stoker; fuel control, fuel conveying, fan capacity, controls, installation; illustrations; 18 pages. Iron Fireman Mfg. Co.

OIL, GAS BURNERS

66 **Oil Burning Systems**—Bulletin 45-1; three types of systems; drawings, tables of capacities and descriptions; photos; 4 pages. Faber Engineering Co.

67 **Mechanical Oil Burners**—Bulletin 45-2; two systems; drawings, tables of capacities and descriptions of units; parts list; 4 pages. Faber Engineering Co.

68 **Oil and Gas Burners**—Bulletin 45-3; combination burner; photos, drawings, tables; 4 pages. Faber Engineering Co.

69 **Oil Burners**—Bulletin 108; Two types of oil burners, A and H; air registers, oil atomizers, drawings; 4 pages. Peabody Engineering Corp.

70 **Gas Burners**—Bulletin 203; description of A and H gas burners; cross sectional diagram; photos of atomizers; 4 pages. Peabody Engineering Corp.

71 **Gas and Oil Burners for Oil Refinery Furnaces**—Bulletin 702; details of firing with gas, with oil; photos; drawings; 4 pages. Peabody Engineering Corp.

WATER TREATMENT

72 **Water Treatment**—Control of Fouling Organisms in Fresh and Salt Water, by John G. Dobson. Life history of these organisms; method of control. Wallace & Tiernan Co., Inc.

73 **Industrial Water Treatment**—Microbiological Control of and Through Industrial Waters; spot summaries of improvement of process efficiency and product quality by proper sterilization. Wallace & Tiernan Co., Inc.

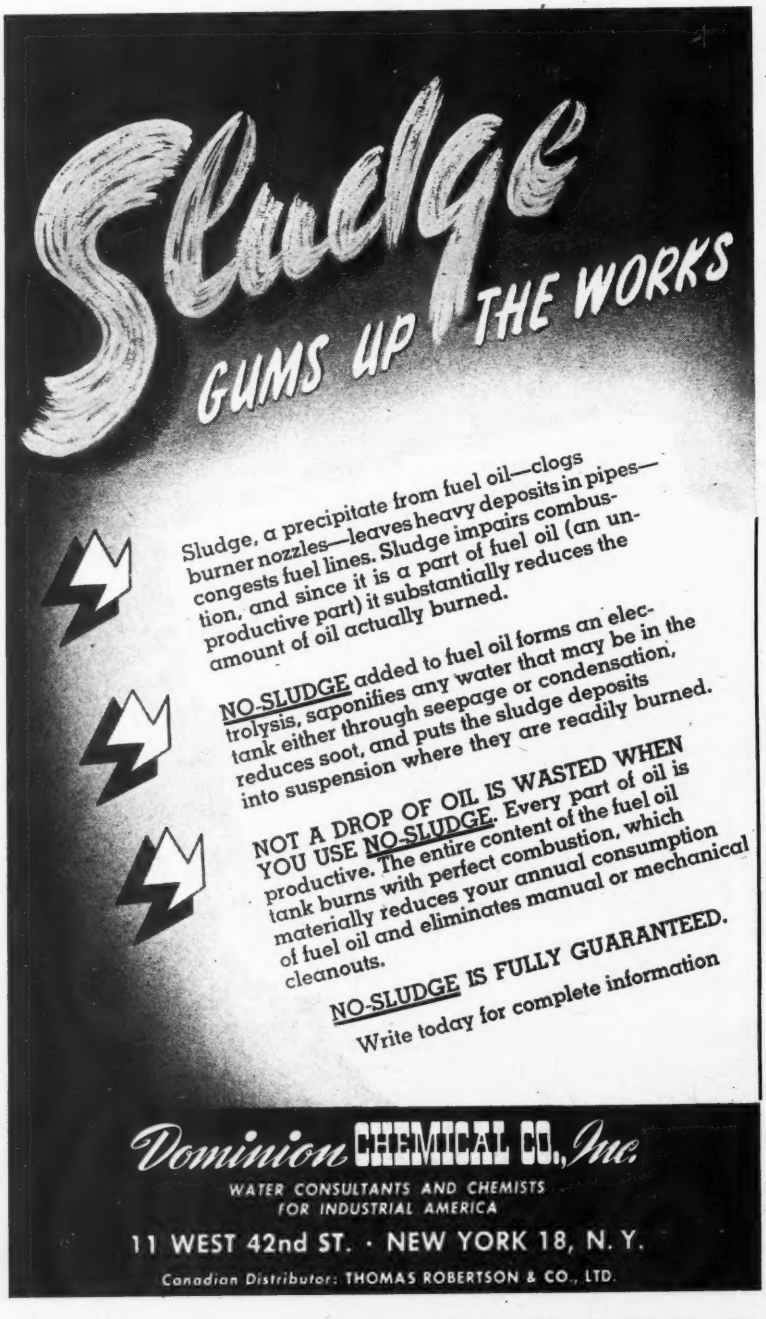
74 **Condenser Water Treatment**—Chlorination of Condenser Cooling Water, by R. B. Martin; important considerations in chemical treatment of cooling water circuits. Wallace & Tiernan Co., Inc.

75 **Water Treatment**—Chlorine Destroys Ammonia, by A. E. Griffin. Gives data on use of chlorine for elimination of ammonia from boiler feed water. Wallace & Tiernan Co., Inc.

76 **Index for Calcium Carbonate**—Reprint of paper by John W. Ryznar; tables and charts; 16 pages. National Aluminate Corp.

77 **Water Treatment**—Bulletin 28S; Scale retardent for use in boilers, feedlines, heaters, etc.; drawing of points of application; composition; 4 pages. National Aluminate Corp.

78 **Boiler Feedwater Q & A**—Bulletin 30; 102 questions and answers on various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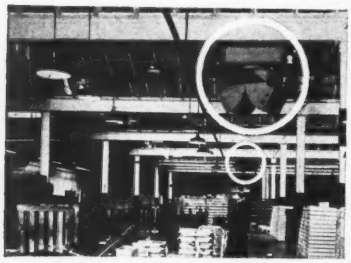
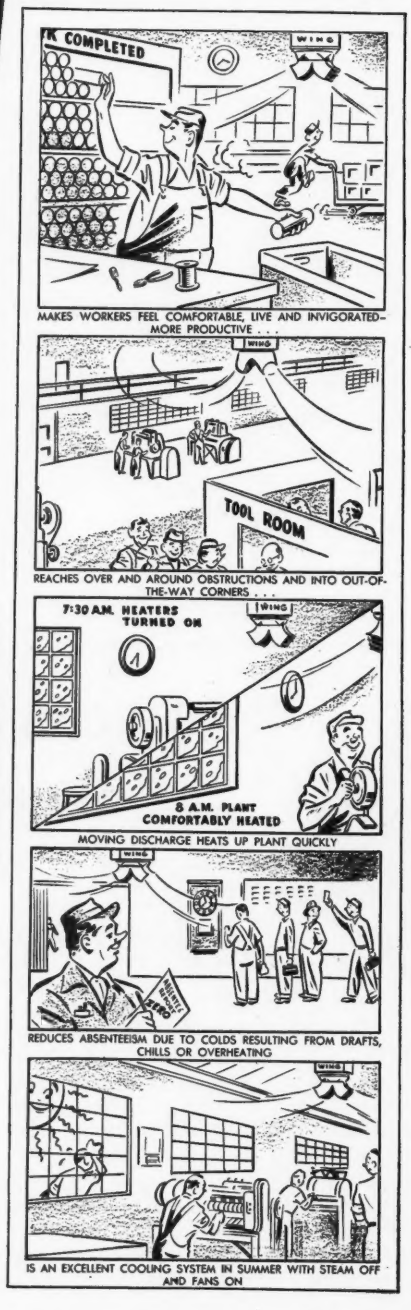


Above: Wing Revolving Unit Heaters in a typical low ceiling type of installation. Revolving Heaters are also made for practically any height roof or ceiling.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80 **Water Treatment**—Scale and corrosion control in potable water supply; reprinted paper presented by Hanlon, Steffen, Rohlich and Kessler; 12 pages. National Aluminate Corp.

81 **Algae and Slime**—Bulletin 31; the elimination of algae and slime in cooling systems, paper mills, etc., drawings, photos; 4 pages. National Aluminate Corp.

82 **Chemical Feeding and Proportioning**—Bulletins 1100 and 1713A; use of adjustable chemical feeder for water treating, sewage, chemical processes, petroleum; plan and sectional diagrams; descriptions; photos; general specifications; 2-page table of capacity schedules; list of chemicals handled; accessories; drawings of boiler water conditioning systems; 5-page description of method of automatic intermittent feed of conditioning chemicals direct to the boilers; 20 pages. Proportioneers, Inc.

83 **Water Treatment**—Various types of water treating; corrosion, carry-over; boiler scale; flexibility; rust prevention; brine treatment; softening and coagulation; cooling and condenser water; chart of treatment in various industries; 24 pages. Western Chemical Co.

84 **Water and Steam Treatment**—Two bulletins on Algaecide and Coravol; when and where algaecide should be used; tells how Coravol operates in the steam system; features and advantages; testimonials; 9 pages total. Western Chemical Co.

85 **Water Softeners**—Bulletin 607; benefits and economies of soft water; typical applications; how it works; types; design and features; backwash and brine rinse regulators; how to modernize present softener; aerators, degasitors, chemical feed systems, chemicals; 20 pages. Elgin Softener Corp.

POWER TRANSMISSION

86 **Speed Reduction, Increase Gear**—Bulletin S130—description; gear cases; gear and pinion; bearings; lubrication; drawings and photos; 8 pages. The Terry Steam Turbine Co.

VALVES

87 **Regulating Valves**—Bulletin 1-A; valve data book; description, dimensions and lists of parts; typical installations; rated capacities; prices; 52 pages. Atlas Valve Co.

88 **Pressure Regulator**—Bulletin 1-B; description, installation, operation; list prices; sectional and installation views; parts lists; 8 pages. Atlas Valve Co.

89 **Pressure Reducing Valves**—Bulletin 1-C; sectional drawings, list prices, dimensions and weights; operation and adjustment; capacities for steam and air; 12 pages. Atlas Valve Co.

90 **Float Valves, Liquid Level Controls**—Bulletin 3; description and list of parts; price lists; operation; adjustment; application and utilization; installation drawings; 8 pages. Atlas Valve Co.

91 **Pressure Reducing Valves**—Bulletin 401-A; selection of proper valve; construction; installation; capacity tables; interchangeability; dimension tables; 14 pages. Leslie Co.

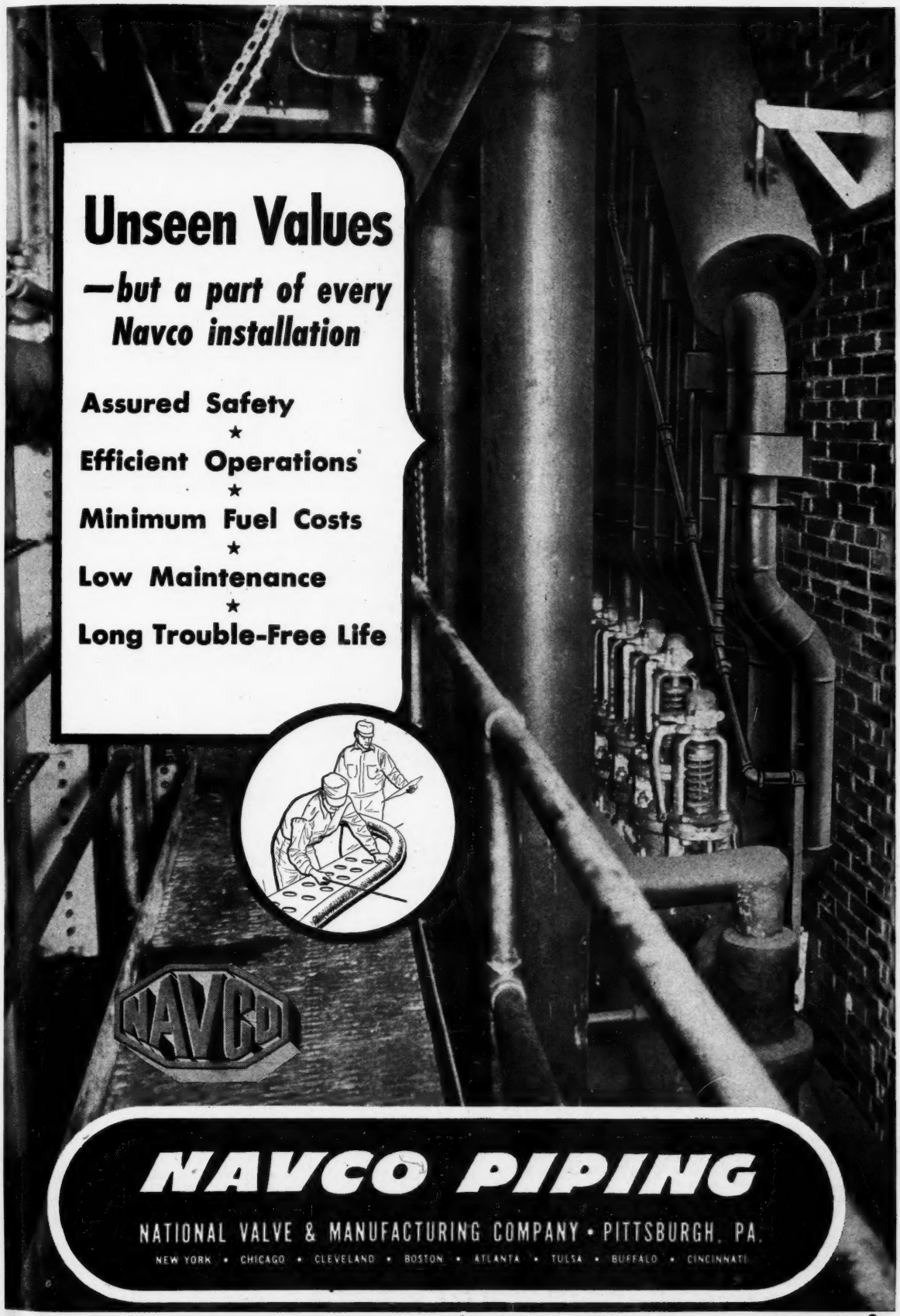
92 **General Service Valves**—Bulletin E-150; valves for blow-off; fire protection, soot blower lines, acids, process, etc.; descriptions; exploded views; features; dimensions, weights and list price tables; parts and parts lists; 14 pages. Everlasting Valve Co.

93 **Valves**—Bulletin E-100; for boiler room service; photos, descriptions, parts; features; pressure rating indexes; size, shipping weight and price tables; ordering information; 30 pages. Everlasting Valve Co.

HEATING, COOLING

94 **Cooling, Heating, Air Conditioning**—Collection of bulletins; installation, design, construction data, capacity ranges, condensed physical data; numerous photos of installations, full page color diagrams of flow of air, compressed air, water, water spray, etc.; 74 pages. Niagara Blower Co.

95 **Steam Conduit System**—Bulletin 381 and 451; tells of foundation, drainage and insulation features; covers tile enve-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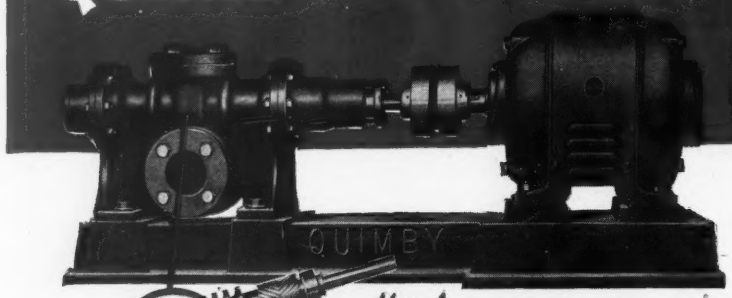

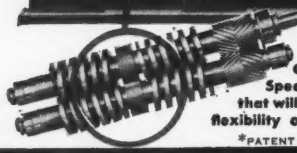

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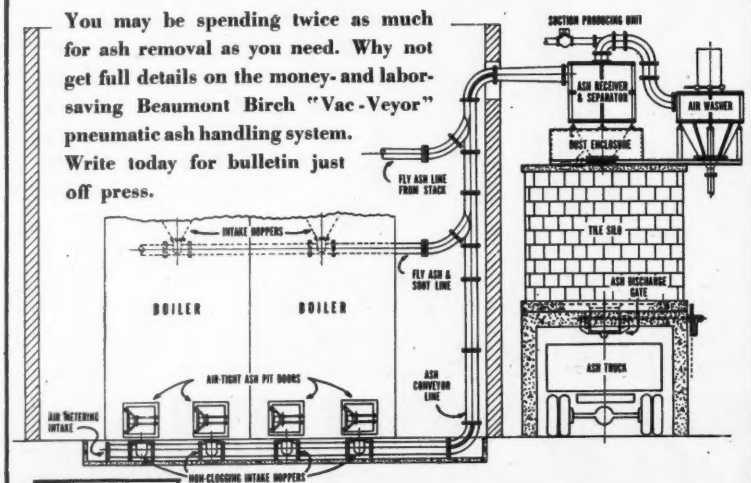

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96 **Lubrication Recommendations**—Special oils for diesels and heavy-duty gasoline engines; facts about oil; tables of recommended oils for various models; 18 pages. Standard Oil Company of California.

97 **Cutting Fluids**—Facts about cutting fluids; machine tool operations; fundamentals of cutting; How to Apply; metallic cutting tools; tabular material; shop practices; 50 pages. Standard Oil of California.

98 **Diesel Operation**—Relation of fuels and lubricants to the operating efficiency in the diesel engine; diesel fundamentals; maintenance; lubrication and fuels; supercharging; selection and classification of fuels; fuel injection maintenance; improving cleaniness; tabular material, charts, formulas; 114 pages. The Texas Co.

99 **Engineers Report on Oil**—Engine tests, laboratory tests, effects on engines, bearing corrosion, actual service data, filter clogging, service experience; well illustrated with photos and charts; 42 pages. Standard Oil Company of California.

100 **Drop Forged Flanges**—Manufacturing processes; physical characteristics; full-page tables of illustrations, dimensions, weights and prices. Space provided for future insertions. Phoenix Mfg. Co.

CONTROLS, METERS

101 **Pressure Controllers**—Bulletin 402; air, gas, steam or water service; when to use; selecting diaphragm regulating valve; sizing and capacity; operation; installation; ordering; specifying; dimensions; diaphragm regulating valves; 12 pages. Leslie Co.

102 **Pump Governors**—Bulletin 403-A; reciprocating, turbine-driven, motor-driven pumps; selection of governor; construction; pressure, capacity tables; installation; sizing; specifying; dimensions; 12 pages. Leslie Co.

103 **Temperature Regulators**—Bulletin 404-A; heating or cooling service; selection of regulator; temperature and pressure ranges; installation; various types described and pictured; ordering and specifying; complete tabular material; 16 pages. Leslie Co.

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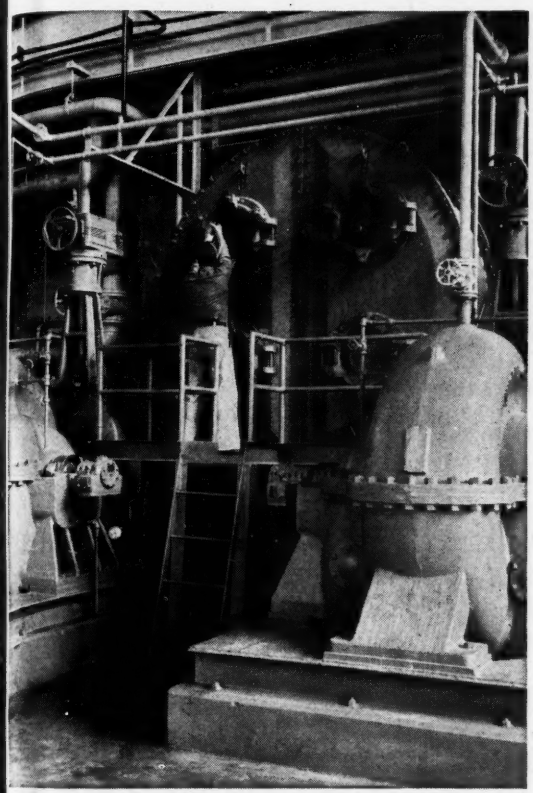

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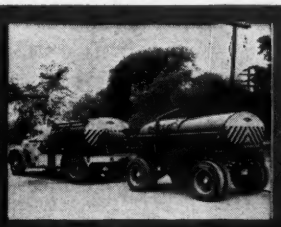

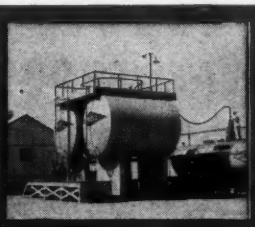

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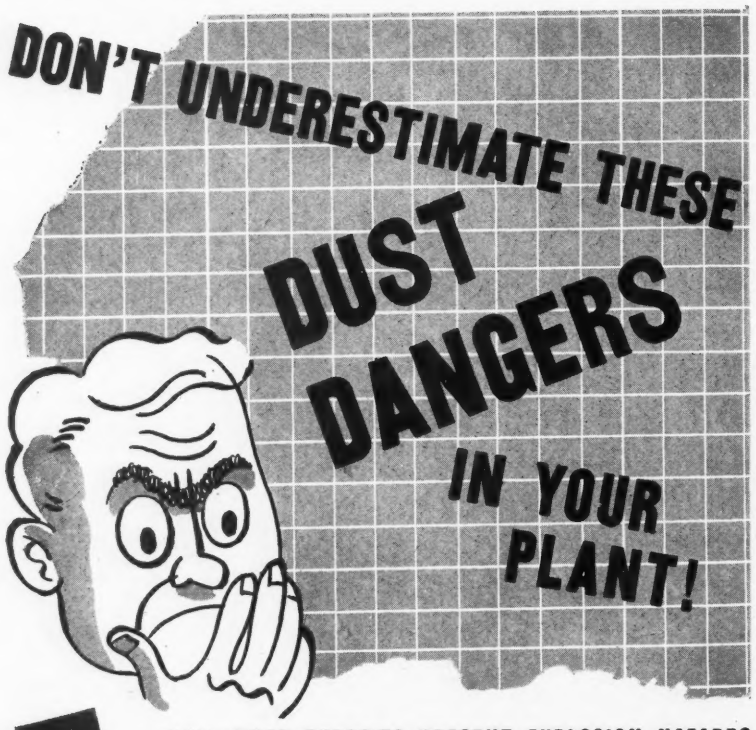

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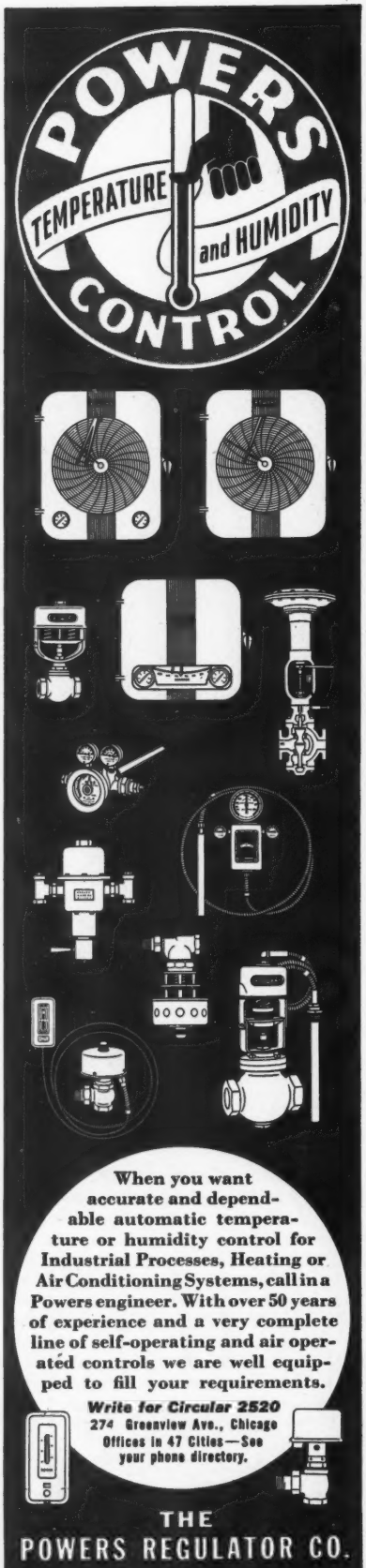
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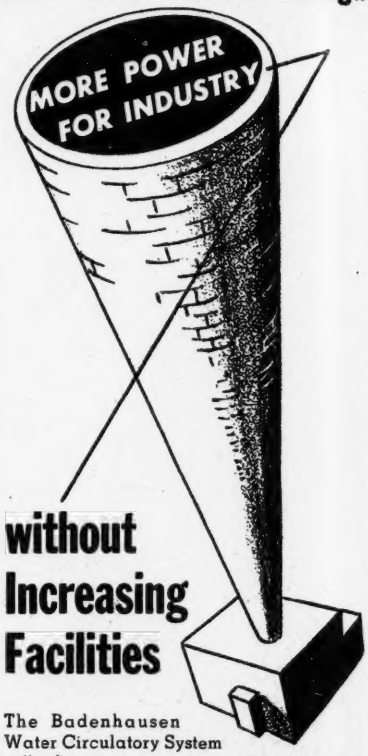

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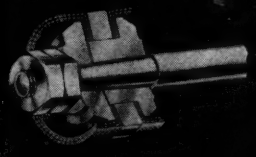

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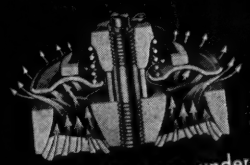

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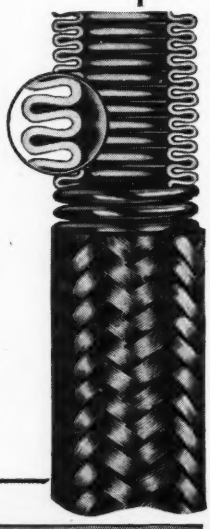

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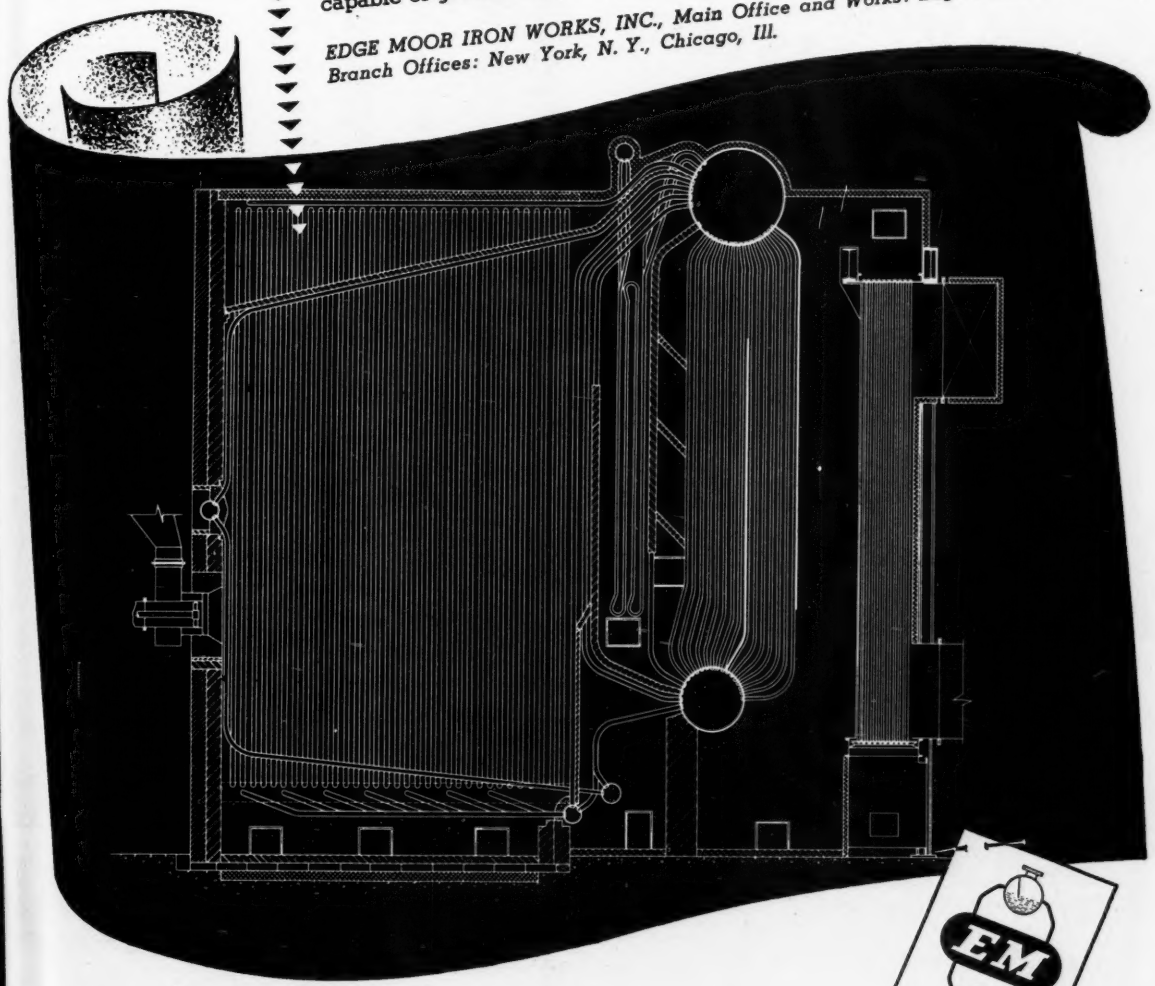

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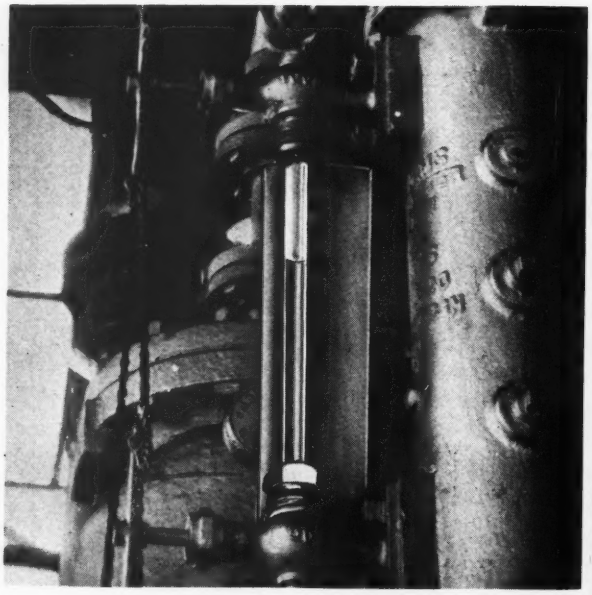

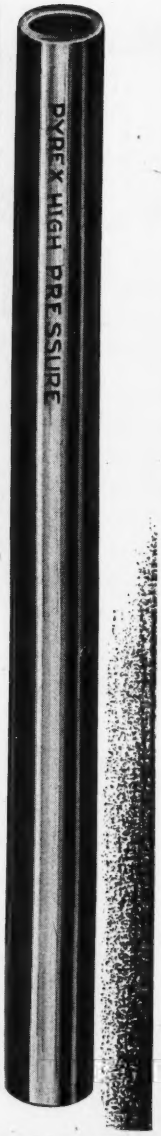

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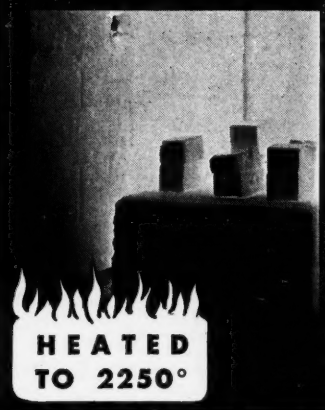

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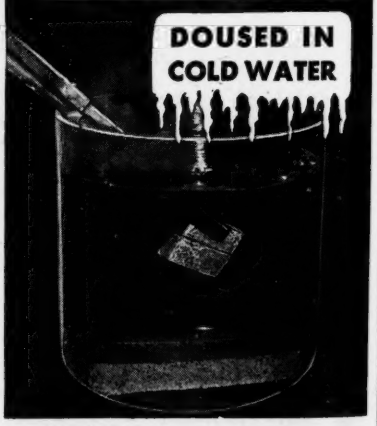

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REFRACTORY COATING

5800 S. Hoover St., Los Angeles, Calif.
1029 Clinton St., Hoboken, N. J.

A NEW, AMAZINGLY EASY WAY TO *Step Up* FURNACE OPERATING EFFICIENCY

FIREMASTER
REFRACTORY COATING

Brush or spray on refractory walls—it vitrifies into a smooth, seamless monolithic coating—impervious to flame and combustion products.

SAVES in 7 WAYS!

- Lengthens refractory life 50% to 250%.
- Cuts brickwork maintenance.
- Prevents cracking and spalling.
- Reflects heat back into furnace—increasing firing efficiency.
- Seals all air leaks—preventing absorption and heat loss.
- Resists flame and fuel abrasion, and sudden temperature changes.
- Reduces slag adhesion.

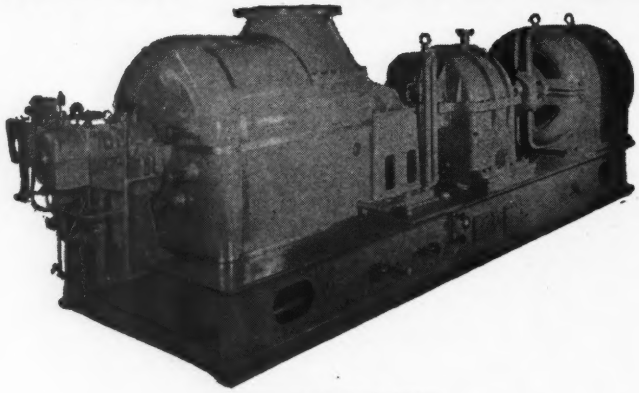
SIMPLE TO USE!

- Requires no shutdown time, other than time required to apply.
- Furnace is fired immediately after application, and operated at once at normal temperatures.
- Application costs far less than average wall repair job.
- Can be used on new or old refractories, in all types of furnaces burning any kind of fuel; any temperature range.

Prices and particulars sent immediately on request. Ask for Bulletin 463

GAALEN REFRACTORIES

MURRAY
TURBINE GENERATORS



500 KW—PACKAGE TYPE

The unit shown above was designed to deliver 500 KW 50 cycle alternating current on steam at 285# gauge, 700 degrees F., and exhausting condensing to 27 inches vacuum. Thirty identical units were furnished.

Equipment included trip and throttle valve, oil relay governor controlling single throttling inlet valve with hand valve control for partial load operation, all service connections above floor line except generator leads, drain piping brought to one point, and structural steel baseplate. The baseplate is sufficiently rigid so that the unit can be handled in one piece, and installed on the simplest of foundations.

While "Package Type" units are furnished for export for installation in remote areas not previously supplied with power, similar designs can be made for industrial plants for main or standby power supply.

MURRAY *also produces:*

Mechanical drive turbines, horizontal and vertical
Reduction Gears Steam Boilers

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

PROCESS STEAM USERS!!

Here is what some of our customers say about our system for returning condensate direct to boiler at high pressure and temperature without traps, orifices or steam reheating in the entire circuit.

From a Silica (glass) Sand Plant using two large sand dryers:

"As near as we can tell from rough check, we are saving approximately 125 tons of coal per month since this unit was put in operation."

From a Plastic Molding Plant:

"We have experienced no difficulty in removing condensate from process equipment and have every reason to believe that the equipment connected to this first unit is being heated more uniformly, and certainly we have been the gainer by eliminating traps." (They now have three return systems in operation.)

From a Meat Rendering Plant:

"To be very conservative, we would say that we are saving 100 tons of coal per month on a 500 H.P. Stirling boiler, and are using very little make up water, with a considerable saving on water softening chemicals, also our cooking time in cooking waste animal material has been reduced 30%."

From a Soy Bean Mill:

"We have two in our soy bean plant—one for each boiler—and we wouldn't be without them for many times the original cost. The oldest one has been in use about five years, I think, and outside of one bearing replacement and occasional repacking, I think we have had no expense on it. The other one has been in service about three years — working constantly 24 hours per day, seven days per week, and as far as I know, the repair costs have been nothing."

We may be able to do as much for you. Anyhow it will cost you nothing to find out. As a general rule, increased production due to the better steam circulation induced by our system and resulting in hotter steam heated units, is worth many times the saving in fuel.

We will gladly analyze your requirements, without cost or obligation, and tell you exactly what we can guarantee to accomplish in your plant. Just drop us a line or give us a ring and you will find us at your service.

HEAT RECLAIMER CORPORATION

Engineers and Manufacturers

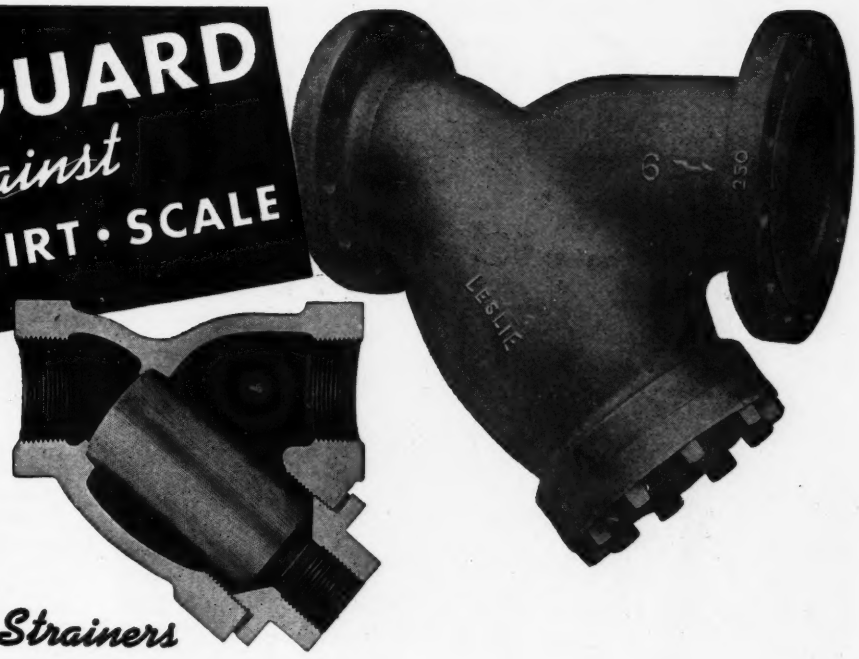
6 NORTH MICHIGAN AVENUE
CHICAGO 2, ILLINOIS

CHANGE OF ADDRESS

To avoid missing an issue or paying for forwarding postage be sure to send a change of address to our office. Changes received by the 20th of the month can be made effective for following month's issue.

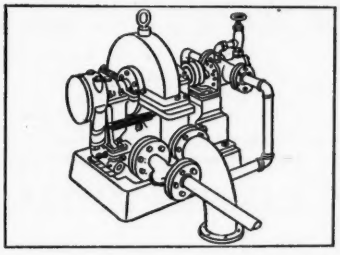
POWER PLANT ENGINEERING

ON GUARD *against* RUST • DIRT • SCALE

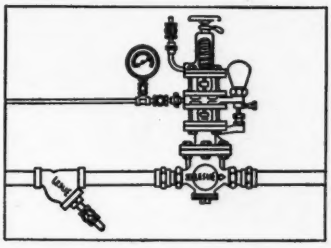


TRADE
LESLIE
MARK

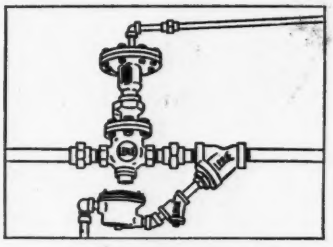
Self-Cleaning Strainers



1. TO PROTECT PROCESS MACHINERY



2. TO PROTECT REGULATORS



3. TO SEPARATE AND DRAIN

LESLIE Self-Cleaning Strainers provide the most inexpensive protection for valves, regulators, turbines, pumps, traps and similar equipment. They prevent *costly shut-downs* and heavy repair bills.

Self-Cleaning feature allows cleaning the screen without removal from strainer body or shutting-off the operating fluid.

Straight thread and gasket joint on *all* screwed end strainers permits easy removal of screen.

FOR ALL COMMERCIAL PRESSURES, they are available in the following body materials, connections and sizes.

Body Material	Connections	Size in Inches
Cast Iron Bronze Cast Steel	Screwed or Flanged	¼—8
Forged Carbon Steel	Socket Welding Ends	½, ¾, 1
Cast C-MO Steel		1, 1¼, 1½, 2
Cast Stainless Steel*	Screwed	½, ¾, 1

*Now available in stock.

SEND FOR Strainer Bulletin 465 containing new chart for computing steam pressure drops through strainers—no obligation.

LESLIE CO.

257 Grant Avenue • Lyndhurst, N. J.

ESTABLISHED 1900
LESLIE
CO.

Look for "LESLIE Regulators" in your classified telephone directory in these cities, for LESLIE factory-trained engineers to help you with your regulation problems:

Atlanta, Ga.
Baltimore, Md.
Boston, Mass.
Bridgeport, Conn.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Tex.
Detroit, Mich.
Greenville, S. C.
Houston, Tex.
Kansas City, Mo.
Los Angeles, Cal.
Louisville, Ky.
Milwaukee, Wis.
Montreal, Que., Can.
New Orleans, La.
New York, N. Y.
Orlando, Fla.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Rutherford, N. J.
San Antonio, Tex.
San Francisco, Cal.
Savannah, Ga.
Seattle, Wash.
St. Louis, Mo.
Syracuse, N. Y.
Toronto, Ont., Can.
Troy, N. Y.
Tulsa, Okla.
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Youngstown, Ohio

PRESSURE REDUCING VALVES • PUMP GOVERNORS • PRESSURE CONTROLLERS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS • LESLIE-TYFON WHISTLES

Specify SONDERGLASS

Be Sure of "BULLS-EYE" Visibility at the Water Line

REFLECTING SONDERGLASS goes a big step further in promoting safety in boiler rooms. It has all the advantages of "clear" SONDERGLASS plus a red and white enameled back which gives the water line "bulls-eye" visibility, even in dark places. . . . You'll find this gauge glass economical, too, because it will not discolor and saves frequent renewals.

★ ORDER FROM YOUR DEALER OR DIRECTLY FROM US

A. W. CHESTERTON CO.

64 INDIA STREET • BOSTON 10, MASS.

DISTRIBUTORS IN PRINCIPAL CITIES

Cuts your gasket costs in half

The most remarkable tool ever invented.

Write for Booklet

THE ALLPAX GASKET CUTTER

Manufactured by

THE ALLPAX COMPANY, INC.

Distributors everywhere *Mamaroneck, N. Y.*

Technical Sales Water Softening Ion Exchange Resins

A well established chemical firm on the Eastern Seaboard has vacancies in its organization for technical salesmen in the new and growing field of the application of ion exchange resins to water conditioning and chemical processes.

Some sales experience in the field of water softening together with chemical engineering training are desirable but not essential. To men of thirty to forty years of age, definitely interested in sales and willing to travel, the positions offer interesting work and excellent future opportunities with a reputable, growing firm. All applications will be acknowledged and treated in confidence. Reply Box 1511, Power Plant Engineering, 53 W. Jackson Blvd., Chicago 4, Illinois.

CLASSIFIED ADVERTISING

HELP WANTED

Power Plant Superintendent

Power plant superintendent under 45 years of age, experienced in high-pressure plant operation, maintenance, and labor relations. Permanent connection, company in middle-west, residence in middle-size industrial community, salary $6,000. Write education, experience, references. Address Box 1508, Power Plant Engineering, 53 W. Jackson Blvd., Chicago 4, Illinois.

DIVISIONAL SALES MANAGER

Desired by nationally known manufacturer of electrical and mechanical control equipment for industrial applications. Technical sales background required. Salary plus commission. In reply give full details.

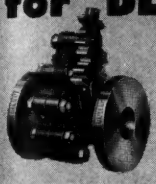
BOX 1512

POWER PLANT ENGINEERING
53 W. Jackson Blvd.
Chicago 4, Illinois

POSITION WANTED

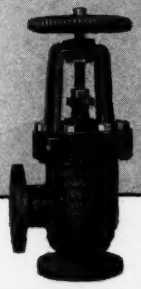
POSITION WANTED—Licensed engineer desires position with reliable firm. Experienced in operation and maintenance of both high and low pressure equipment. Family man, can furnish excellent references. Will accept only permanent position. Address Box 1513, Power Plant Engineering, 53 W. Jackson Blvd., Chicago 4, Illinois.

CO-ORDINATED for BLOW-OFF SAFETY



THIS IS THE SEALING VALVE

THIS IS THE BLOWING VALVE



EVERLASTING DUPLEX BOILER BLOW-OFF UNIT, COMPLETE

A "regular" *EVERLASTING* Valve that opens fully with one short movement of the lever . . . a wheel-operated *EVERLASTING* Companion Valve built to take the full punishment of the blow-off . . . these two valves, coupled together, provide a combination that meets full code requirements for dual-valve blow-off.

The lever-operated *EVERLASTING* Valve, designed for unimpeded, straight-through flow, maintains its tight seal, because it re-grinds itself with each operation. It cannot wedge or stick.

The *EVERLASTING* Companion Angle Valve, designed specifically for blow-off service, stoutly resists erosive blow-off water and the abrasive action of solids in such water.

Either valve obtainable separately if desired.

For full information write us for *EVERLASTING* Bulletin E-100.

EVERLASTING VALVE CO.
49 Fisk St. Jersey City 5, N. J.

EV-274

Everlasting Valves

for everlasting protection

ADSCO

HEAT EXCHANGERS

STRAIGHT TUBE AND U-TUBE TYPES

Engineered for **MODERN PROCESSING**

Wherever industrial processes involve heating and cooling of liquids, ADSCO provides a complete line of horizontal and vertical heat exchangers. Available in a wide range of sizes built to standard and custom requirements and fabricated with ferrous and non-ferrous alloys. ADSCO engineers are at your service to aid in selecting or designing heat exchangers to meet your needs.

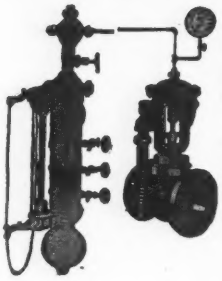
Write for Bulletin 35-76 E

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

No Floats
No Links
No Generators

No Thermostats
No Moving Parts

CAMPBELL
Boiler Feed Water Regulator



The Figure at the Left Shows the CAMPBELL Regulator and Sampling Pipe.

The Figure at the Right Shows the ATLAS Control Valve, which is easily piped to the Regulator, at any Distance.

The CAMPBELL Saves Labor, Saves Fuel, Eliminates Trouble, and Insures Proper Water Level in Any Boiler, Regardless of Size.

In this limited space we can't tell all about the CAMPBELL, so, ask for complete data. For instance, we have a pamphlet which gives "17 Reasons Why the CAMPBELL Is Preferred by Boiler Operating Engineers." Reason No. 16 is: "The money saved by the use of the CAMPBELL in the course of a year is usually much more than enough to pay the first cost of the entire installation." There are 16 other reasons. Ask for them.

In addition there are other ATLAS products in which you may be interested, listed below. Check those items on which you want data and mail to us with your name and firm address.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

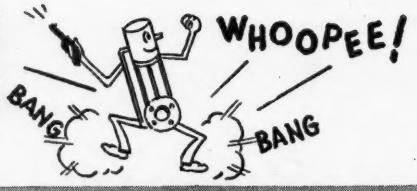
291 South St., Newark 5, N. J.
Representatives in Principal Cities

☐ Please send complete information on the CAMPBELL Boiler Feed Water Regulator. Also please send information on the following ATLAS products as checked—

☐ Damper Regulators
☐ Temperature Regulators
☐ Reducing Valves
☐ Exhaust Control Systems
☐ Pressure Regulators
☐ Pump Governors
☐ Float Valves
☐ Oil Control Cocks
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves

Name _____
Firm _____
Street _____
City _____ State _____

Bothered by SLAM-BANGING Pumps?

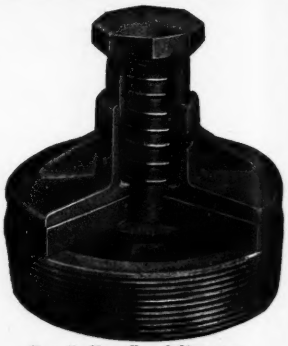


They'll run slower and quieter with **COMBINATION**
NON-TILT, NON-SLIP VALVES

Two reciprocating feed pumps at a water plant in New Jersey each handled 40,000 lb of condensate and make-up water per hr. Their valves not only needed frequent repairs, but the pumps raced and hammered whenever the water temperature went up to 218 deg. F.

After installing COMBINATION Pump Valves this plant engineer reported "a slowing and steadying with elimination of former racing and hammering."

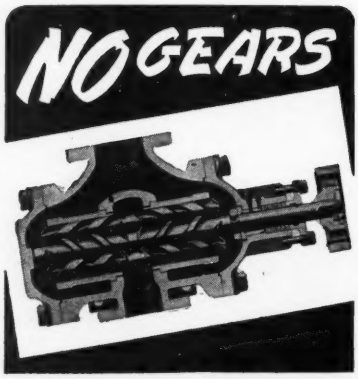
What COMBINATION Pump Valves are doing for hundreds of other plants, they can do for you. They lift straight, close quickly, prevent slippage, make steam do more work. Seat, stud and springs are made of long-wearing Phosphor Bronze. They match the fine performance of COMBINATION Silent Check Valves. Write for descriptive folder.



For Boiler Feed Vacuum, Condenser General Service

COMBINATION PUMP VALVE CO. 846 WIOTA STREET PHILADELPHIA, PA.

NO GEARS



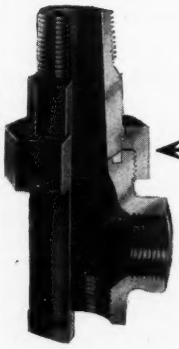
The IMO PUMP requires no gears, because the fluid pumped is propelled from suction to discharge by the action of three intermeshing rotors. That's all there is to it—no gears, valves, vanes or pistons!

For simplicity, reliability and compactness select the IMO—for use in hydraulic service, governor service, lubrication service and other fluid handling services.

For further information send for catalog I-132 -G.

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

Specify JEFFERSON Specialty UNIONS



with the RECESSED BRASS SEAT

for Leakproof Piping

These Union Tees which have the union on the run will be found exceedingly useful where piping involves a union near a tee. They are rated "Tops" by engineers because they simplify installation, save pipe joints and assure permanent leakproofness. Made with pipe ends threaded either All-Female or Male and Female.

The Recessed Brass Joint in Jefferson Specialty Unions provides a brass to iron joint which avoids corrosion. It is forced into a machined recess and processed to insure a thorough, permanent tight contact between the ring and the spherical surface of the surrounding iron.

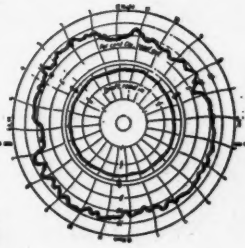
For complete details, contact us or your nearest distributor.

JEFFERSON UNION CO.
601 West 26th Street, New York 1, N. Y.
Factories at Lexington 73, Mass.; Lockport, N. Y.

UNIFORM COAL SIZING REDUCES...

RAGGED FIRING

EXCESSIVE CO_2



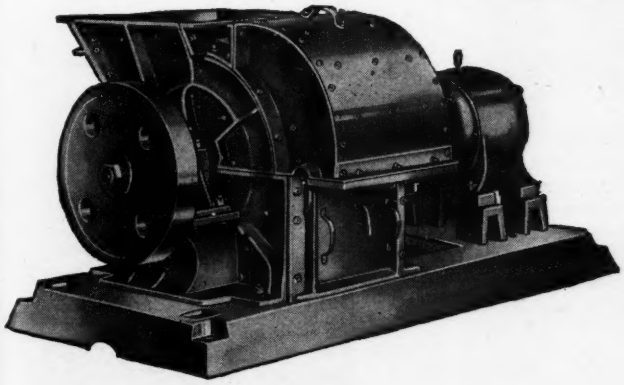
ASHPIT LOSS

do it with an AMERICAN *Rolling Ring* CRUSHER

•

Ragged firing—with alternately excess air and insufficient air . . . excessive CO_2 instead of uniform combustion . . . excessive ash pit drops—are all costly and inefficient results of coal not uniformly sized.

Coal, even poor grades, is ***uniformly*** reduced by American Rolling Ring Crushers for improved firing efficiency and for lower cost of handling. Control of fines and no oversize provides for uniform, high combustion. Complete handling of refuse and positive rejection of tramp iron safeguards against damage to mechanical firing devices. The efficiency and low 1c per ton operating cost, of American Rolling Ring Crushers results the rapid splitting-impact, action of Americans patented shredder rings. The shredder rings revolve free on their own shafts—each with 20 cutting teeth that split coal instead of crushing it. They deflect from tramp iron.



Write for your copy of
"Crushing Coal at Less Than 1c Per Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1429 Macklind Ave.
St. Louis 10, Mo.

solved by Oakite

Clean Transformers This New, Fast, Low-Cost Way!

Today, most oil-cooled, breather-type transformers are working overtime. As a result of this extra duty, oil oxidizes . . . heavy sludge forms in the tubes and on the walls of the transformer case. This condition prevents proper heat transfer. The resultant abnormally high operating temperatures may cause burn-outs, explosions or other costly transformer trouble.

Prevent Trouble!

Sound preventive maintenance practice is to desludge units periodically. This you can do with a minimum of equipment out-of-service time by adopting the proved Oakite procedure of circulating through tubes . . . spraying on transformer walls a recommended solution of heavy duty Oakite alkaline type cleaner. Follow with rinsing-drying operation, and the job is done. Transformer is back in shape to operate efficiently.

Technical Help FREE

Complete step-by-step details gladly mailed on letterhead request. If you prefer, ask your nearby Oakite Technical Service Rrepresentative to give you on-site help with this time-saving Oakite technique. Both services, yours for the asking. Either way, consult Oakite TODAY!

OAKITE PRODUCTS, INC.
16C Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS • METHODS • SERVICE

10 *Advantages of* NICHOLSON EXPANSION STEAM TRAPS

1. Easily adjusted for any pressure from 0 to 250 lbs. without change of valve or seat.
2. Valve is adjustable for regulating temperature of condensate.
3. Entirely automatic action.
4. Quiet, continuous discharge.
5. Discharge air as efficiently as water.
6. Wide open when cold.
7. No air binding; no freeze-ups.
8. Valve and seat of hardened stainless steel.
9. In various overall lengths, 18" to 40", to suit space.
10. Two types: thermostatic; continuous flow.

For complete details of these effective, low-cost expansion steam traps, send for BULLETIN 444.

W. H. NICHOLSON & CO. 160 OREGON ST., WILKES-BARRE, PA.

NEW LaMOTTE PHOSPHATE COMPARATOR

A rapid and accurate method of control in treatment of Boiler Feed Water to prevent scaling. Range of concentration covers 0 - 100 ppm. of phosphates. Same comparator can be used for polyphosphates. Complete unit $15.00 f.o.b. Towson 4, Maryland.

LaMotte makes similar outfits for other control tests. Information will be supplied upon request without obligation.

If you do not have the LaMotte A B C of pH Control, a complimentary copy will be sent upon request without obligation.

LaMOTTE CHEMICAL PRODUCTS COMPANY
Dept. PPE Towson 4, Maryland

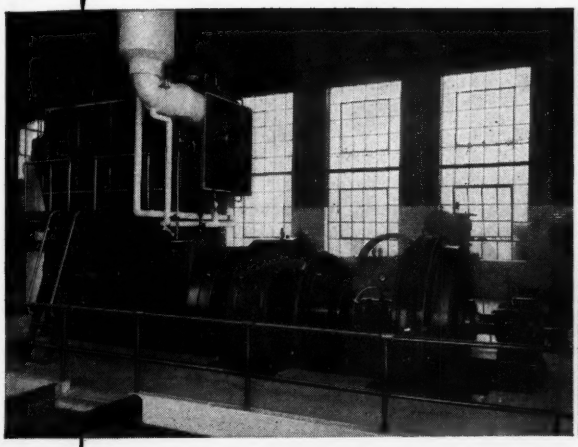
Consult Us For:
CHIMNEYS . . .
FURNACE WORK . . .
BOILER SETTINGS

AMERICAN CHIMNEY CORP.
143 Fourth Ave., New York 3, N. Y.
BRANCHES:
BOSTON • PHILADELPHIA • CLEVELAND
DETROIT • PITTSBURGH • CHARLOTTE

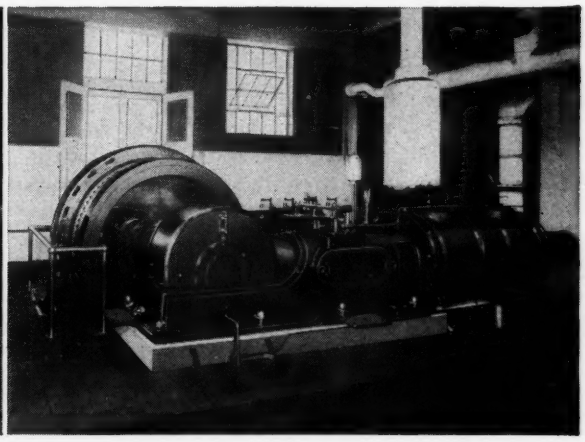
Skinner "UNIVERSAL UNAFLOW"

The Most Economical STEAM ENGINE Built

for Generating Electric Power or Driving Compressors, Blowers, Pumps, Lineshafts . . .



● 4-Cylinder Vertical 800-Kilowatt "Universal Unaflow" in Plant of Machine Tool Manufacturer



● 300-Kilowatt Horizontal "Universal Unaflow" in Meat Packing Plant

YEAR after year the sales of Skinner "Universal Unaflow" Steam Engines continue to grow; old customers install additional units; new customers replace purchased power with power generated under their own roof, or replace other types of prime movers with "Universal Unaflow" engines.

The "Universal Unaflow" is not just another steam engine; it is the outstanding reciprocating steam prime mover of this era. The performance of thousands of "Universal Unaflow" engines, in almost every type of industry and institution, daily demonstrates the truth of our claim—that they are "the most economical steam engines built."

"Universal Unaflow" engines are correctly designed for simplicity, dependability, heavy duty service, flexibility, and permanently maintained economy. They are built for direct connection, coupling, or belt drive, to electric generators, compressors, blowers, pumps, lineshafts, or other load. They are available in sizes ranging from 50 to 2000 hp., and in horizontal or multi-cylinder vertical types.

Write us for details, and for information about the performance of "Universal Unaflow" Steam Engines in your particular type of industry.

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

LOW COST DEMINERALIZED WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

★ Demineralized Water suitable for many requirements demanding distilled water, can now be obtained at a fractional part of the cost of distillation. Belco deliveries are surprisingly rapid.

MODERNIZE YOUR ZEOLITE WATER SOFTENERS

The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

BELCO INDUSTRIAL EQUIPMENT DIVISION
50 IOWA AVENUE
PATERSON 3,
NEW JERSEY

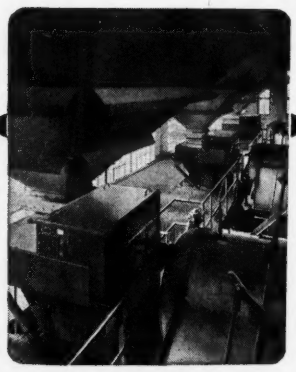
CHECK WITH BELCO...first!

Belco

INDUSTRIAL PROCESSING EQUIPMENT SINCE 1892

DETERMINE { BOILER EFFICIENCY EVERY DAY—FOR EACH BOILER

WEIGH *all coal accurately on Richardson Automatic Coal Scales*



View showing top of boilers and storage hoppers with Richardson Automatic Coal Scales at bases. Weighing is automatic with visual indication of accuracy. Coal is then fed directly to stoker hoppers.

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POWER PLANT *Construction News*

Calif., Bakersfield—Pacific Gas & Electric Co., 245 Market St., San Francisco, Calif., plans new steam-electric generating station near Green Acres, about 3 mi. from Bakersfield, where site has been selected. It will be known as Kern Steam Plant, with installation to include an 80,000-kw turbine-generator and accessories, two high-pressure boilers equipped for oil or natural gas fuel and complete auxiliary equipment. Extensions will be made in transmission lines for connection with present high-tension system. Entire project is reported to cost approximately $10,000,000. Work scheduled to begin in October.

Calif., El Centro—United States Gypsum Co., 816 West 5th St., Los Angeles, Calif., plaster, wallboard, insulating board, etc., plans new wallboard plant at Plaster City, about 17 mi. from El Centro, comprising a main one and multi-story processing and production building, and several smaller structures, to be equipped for large output. Electric power equipment will be installed. A boiler house and power substation are planned. Entire project is estimated to cost close to $2,500,000. Work will begin soon. Main offices are at 300 West Adams St., Chicago, Ill.

Conn., Bridgeport—Casco Products Corp., 512 Hancock Ave., electrical appliances, automotive specialties, etc., plans new boiler house at factory, 40 x 60 ft. Cost close to $100,000, with equipment. CPA, Federal agency, has approved project and work is scheduled to begin soon. Westcott & Mapes, Inc., 109 Church St., New Haven, Conn., is consulting engineer.

Conn., Hartford—Hartford Gas Co., 233 Pearl St., has approved plans for new compressor station at artificial gas plant on Front St. Cost reported about $100,000. United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa., engineer and contractor, has prepared plans and will supervise construction.

Fla., Lakeland—Lakeland Tannery Association, E. I. Radke, president, plans boiler plant in connection with new local leather tannery. Main factory unit will be one-story, 80 x 300 ft. Electric power equipment will be installed. Entire project will cost over $100,000. Work will be carried out soon.

Fla., Tampa—Tampa Electric Co., Cass and Tampa Sts., is reported planning new steam-electric generating station on local site, supplementing present power plant. Size and details, with estimated cost will be determined in near future. Project now said to be in preliminary stage.

Iowa, Hampton—Federated Cooperative Power Assn., Hampton, plans expansion in generating station, with installation of equipment to increase capacity from 7330 to 14,490 kw. It is understood that Diesel engine-generator units will be installed. Cost about $1,100,000. Financing has been arranged through Federal aid.

Iowa, Lansing—Interstate Power Co., Dubuque, Iowa, has plans for use for new power plant at Lansing, and will begin work soon on steel frame superstructure. No estimate of cost announced. Extensions will be made in lines in that area.

Iowa, Pocahontas—Central Electric Federated Cooperative Assn., Pocahontas, plans expansion in local generating station, with installation of three new 1600-kw Diesel engine-generators and auxiliary equipment. Cost estimated about $550,000. Financing has been arranged through Federal aid.

Kan., Dighton—Town Council plans extension and improvements in municipal power plant, with installation of additional equipment. Fund of about $115,000 is being arranged for this and improvements in water and sewage systems. Special election will be held to approve bonds in amount noted. H. R. Hunter, 105 West English St., Wichita, Kan., is consulting engineer.

Kan., Salina—Board of Commissioners has authorized new water-softening plant for municipal water system. Cost reported over $250,000. Bids will be asked in near future. Wilson & Co., Salina, are consulting engineers.

Ky., Paris—Municipal Light & Water Dept., 410 Main St., has plans maturing for new addition to municipal power plant, with installation of equipment for increased

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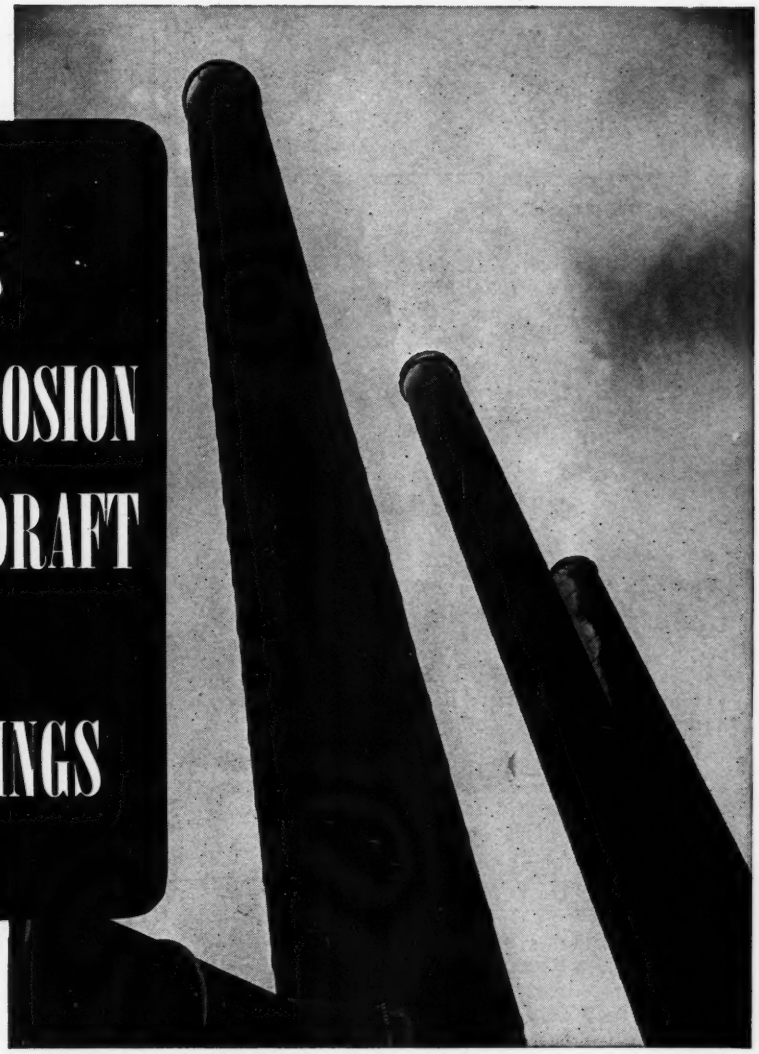

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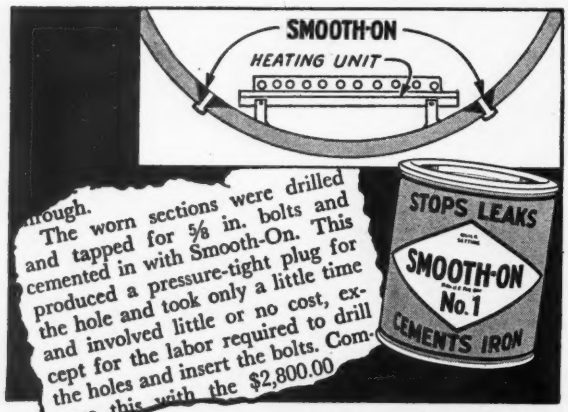

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capacity. No official estimate of cost announced. E. C. & G. T. Landberg, 114 Garfield Pl., Cincinnati, Ohio, are architects.

Mich., Battle Creek—Post Products Div., General Foods Corp., Cliff St., cereal products, plans extensions and improvements in power plant at mill, including installation of coal-handling and other equipment. Cost estimated close to $75,000. Project has a priority rating from CPA, and work will be carried out soon.

Mich., Cassapolis—Fruit Belt Electric Cooperative, Cassapolis, has plans in progress for extensions in power plant, including installation of two 750-kw Diesel-generator units and accessories. Also will make additions to rural electric system. Cost about $325,000. Financing is being arranged through Federal aid.

Mich., Ishpeming—Robbins Flooring Co., Rhinelander, Wis., wood flooring, plans new mill in vicinity of Greenwood St. and Washington Ave., Ishpeming, consisting of several one-story buildings. Electric power equipment will be installed. It is understood that a boiler house will be built. Entire project is reported to cost about $200,000.

Mich., Sault Ste. Marie—United States Engineer Office, Guardian Bldg., Detroit, Mich., is reported making surveys and preparing plans for new generating station at St. Mary's Falls Canal, Sault Ste. Marie, to cost approximately $3,500,000. It is understood that plant will be of hydroelectric type.

Minn., St. Paul—Northern Pacific Railway Co., Northern Pacific Railway Bldg., plans installation of power equipment in connection with expansion and remodeling of portion of shops at yards on Mississippi St., to provide new overhaul and repair shops for steam and Diesel locomotives. Cost reported approximately $350,000. Project has been approved by CPA, Federal agency, and work will begin at once. L. B. Curtiss, address noted, is company architect.

Mo., Sedalia—Pittsburgh-Corning Corp., 632 Duquesne Way, Pittsburgh, Pa., glass blocks, cellular glass products, etc., plans installation of electric power equipment in new branch plant near Sedalia, where tract of about 40 acres of land has been acquired. It will comprise several one and multi-story buildings, equipped for large output. A boiler house is planned. Entire project will cost about $2,000,000. H. K. Ferguson Co., Hanna Bldg., Cleveland, Ohio, is engineer and will supervise construction.

Ohio, Cleveland—Cleveland Electric Illuminating Co., Public Sq., will begin superstructure soon for addition to steam-electric generating station on Canal Rd., for expansion in steam department. Cost estimated about $750,000, with equipment.

Ohio, Cleveland—Dobeckmun Co., 3301 Monroe Ave., cellophane bags, envelopes, etc., plans installation of electric power equipment in new two-story addition to converting plant, about 50,000 sq ft floor space. Cost estimated about $200,000, with machinery. Work will proceed soon.

Okla., Stillwater—City Council has plans under way for expansion and improvements in municipal steam-electric generating station, with installation of turbine-generator and accessories to double present capacity. Cost about $388,000. Bond issue in that amount has been authorized. Midwestern Engineers, Inc., 105 North Boulder St., Tulsa, Okla., is consulting engineer.

Pa., Meadville—American Viscose Corp., viscose rayon products, plans installation of electric power equipment in connection with expansion and improvements in mill at Meadville, including additional buildings, with machinery for large increased output. Cost reported in excess of $1,000,000. Rust Engineering Co., Clark Bldg., Pittsburgh, Pa., is engineer and will supervise construction. Main offices of company are in Delaware Trust Bldg., Wilmington, Del.

Texas, Austin—At recent special election, propostion to issue bonds for $770,000 for extensions and improvements in municipal power plant, previously noted in these columns, was defeated and project will be held in abeyance until later date.

Texas, Midland—Frontier Chemical Co., Curtis W. Cannon, vice-president and general manager, P. O. Box 5311, Seagraves, Texas, plans installation of electric power equipment in new one-story plant on local site for manufacture of hydrochloric acid, caustic soda, etc. Cost reported close to $400,000. Work is scheduled to begin during summer.

Utah, Spring City—Municipal Power Dept., plans extensions and improvements in municipal hydroelectric generating station, estimated to cost about $80,000. Financing has been arranged through Federal aid.

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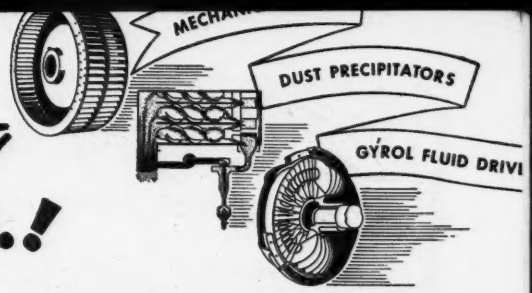

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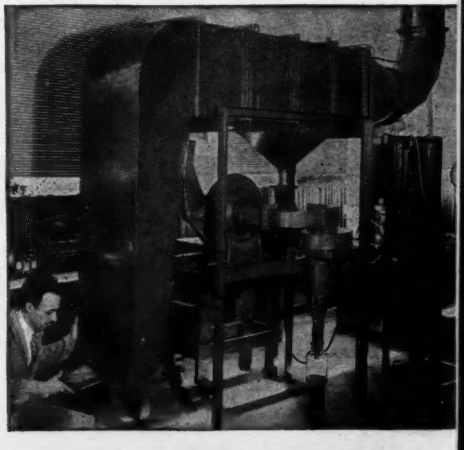

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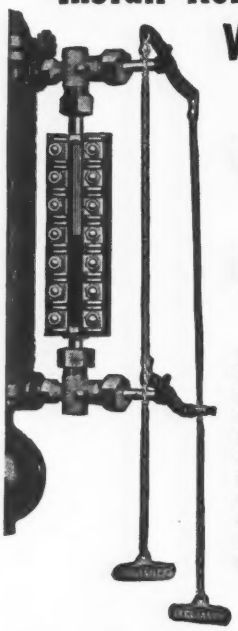

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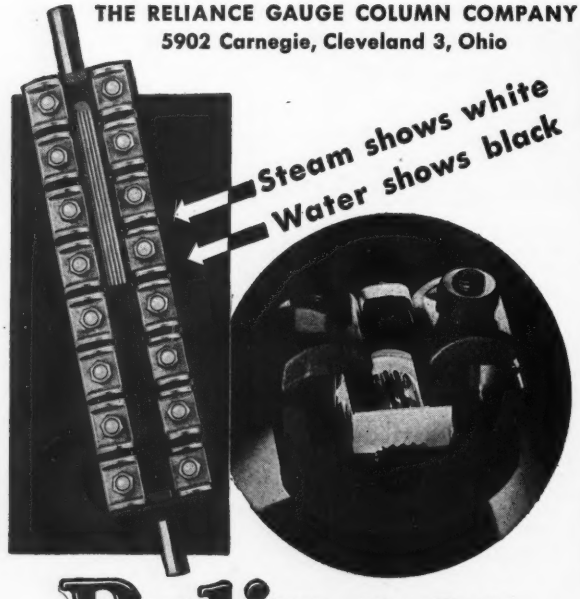

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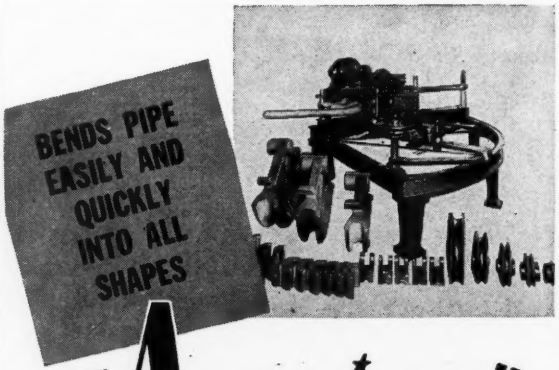

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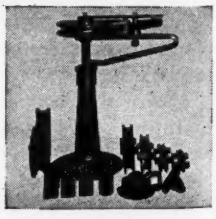

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Condenser and Heat Exchanger Tubes

Most Common Factors Influencing Corrosion Rate

Numerous laboratory examinations of condenser tubes which in some instances have given many years of service and in others only a few weeks or months of service, have revealed that there are probably at least a dozen different factors which influence the rate of corrosion of condenser or heat exchanger tubes in power plants. These factors may function in an adverse manner or they may be beneficial as listed in the table below. The problem is complicated by the interaction of these factors. This should not necessarily discourage us from trying to uncover the most troublesome factor or combination of factors. In many instances individual consideration of all of these corrosion rate factors has helped to uncover the most troublesome one.

In previous issues of the Copper Alloy Bulletin, we discussed the effects of alloy composition and water composition, as well as the acceleration of corrosion due to the deposit of foreign matter. We also mentioned a few of the preventive measures to increase tube life such as cleaning of tubes and removal of a large percentage of entrained gases from the circulating water before it enters the tubes.

Steam and Steam Condensates

All of the copper base alloys usually have excellent corrosion resistance to steam and steam condensates of low impurity content. Occasionally stress corrosion cracking or corrosion grooving localized near tube sheets and supports is encountered where the condensate contains much ammonia. Corrosion grooving sometimes occurs when much carbon dioxide is present. Thinning of tubes has also occurred when much hydrogen sulfide was present.

High Water Velocity May Lead to Impingement-Corrosion

In condenser and heat exchanger tubes the movement or turbulence of some waters at the inlet ends of tubes frequently leads to localized corrosion—commonly called "impingement-corrosion" or "inlet-end-corrosion". The seriousness of this type of attack varies with the alloy composition, water composition, water velocity and the quantity and size of entrained gas bubbles and sand. When much entrained gas is present in the water stream, the impingement corrosion pits are undercut on the down stream side at those points where the gas bubbles (second phase) impinge on the metal surface. Aluminum Brass, 70/30 Cupro Nickel containing about ½% iron and Duronze IV (arsenical aluminum bronze) have the best corrosion resistance to this type of attack in sea water. "Inlet-end-corrosion" is also combated through the use of various protective measures applied to the inlet ends of tubes, such as Flowrites, plastic inserts, and coatings.

Effects of High Velocity Steam

Steam containing droplets of water (second phase) traveling at high velocities and impinging on condenser and heat exchanger tubes will rapidly corrode most metals. This is usually encountered in those tubes facing the steam inlet and steam lanes. The surface is roughened by numerous cones all tilted in one direction. Sometimes the tips of the cones do not develop and the corroded surface may be covered with a large number of minute cones with rounded tops. Trouble from this source is kept to a minimum by (1) removing as much moisture as possible from the steam, (2) use of the most corrosion resistant metals, (3) maintaining high quality steam and (4) the use of steam deflector plates.

Effect of Internal and External Stresses

The effect of applied (static) or residual (resulting from cold drawing) stresses upon the copper base alloys varies considerably depending upon the composition of the alloy and the corrosive environment (moist ammonia). Certain copper alloys under these conditions may fail from localized corrosion (stress corrosion or season cracking) in the form of narrow cracks which gradually penetrate the tube wall. This type of corrosion is best combated by keeping stresses and the concentration of ammonia at a minimum; where these cannot be controlled then the use of copper, 70/30 cupro nickel, or Duplex tubing should be considered. Residual stresses resulting from cold work during the manufacture of tubes are eliminated by the stress relief obtained by annealing to meet the grain size requirements of A.S.T.M., Federal, Navy, and other specifications. Duplex Tubes, however, are normally supplied in the hard condition.

Cyclic stresses associated with vibration may lead to fatigue or corrosion fatigue cracking of condenser and heat exchanger tubes. These failures can be recognized from their location, that is, a few up to several hundred minute circumferential cracks develop midway between tube support sheets or within a few inches from the tube sheets. In addition such tube failures generally occur at those points where the steam or vapors enter the condenser or heat exchanger, that is, in tubes facing the inlet or vapor lanes (top to bottom of lane). Stopping the vibration is the most satisfactory way to combat this situation. This has been done through the use of tube stiffeners and additional tube support plates.

Alloy Selection

As we learn more about the complex subject of corrosion, we begin to appreciate the very important role played by the metals and alloys from which condenser and heat exchanger tubes are made. Engineers who take the trouble to study experimental lots of different alloys tested under actual service conditions are of course in an excellent position to know, when the time for retubing comes around, which alloy will serve best. Such results lead to the purchase of tubes on a service basis rather than on a first cost basis. Further information on condenser and heat exchanger tubes can be obtained from our Technical Service Dept. Write for your copy of Bridgeport's Condenser Tube Manual—112 pages full of technical data and useful tables.

Most Common Factors Influencing the Rate of Corrosion

The letter or letters in parentheses following each factor indicates whether or not this factor generally has an adverse ("a") or beneficial ("b") effect on the corrosion rate as the value of concentration increases.

1. Alloy Composition ("a" or "b")
2. Composition of Water
   - (a) Anions, specific nature and concentration ("a" or "b")
   - (b) Cations, specific nature and concentration ("a" or "b")
   - (c) Total dissolved solids ("a" or "b")
   - (d) pH and pHs ("a" or "b")
   - (e) Gases, H_2S, Cl_2, CO_2, O_2, NH_3 (usually "a" occasionally "b") rate of supply, concentration, distribution.
   - (f) Organic Material, specific nature and concentration ("a" or "b")
   - (g) Total suspended matter, nature, size, etc. ("a" or "b")
   - (h) Conductivity ("a")
3. Composition of Steam and Steam Condensate Similar to items 2a to 2h
4. Nature and Distribution of
   - (a) Corrosion products ("a" or "b")
   - (b) Silt and debris ("a" or "b")
5. Velocity of
   - (a) Water with ("a") and without a second phase (solid or gas)
   - (b) Steam with ("a") and without a second phase (liquid)
6. Stress
   - (a) Static ("a")
   - (b) Residual ("a")
   - (c) Cyclic ("a")
7. Design of Heat Exchanger ("a" or "b")
8. Operation of Heat Exchanger
   - (a) Continuity of operations (affects factors 5, 6, 8, 9 and 11) ("a" or "b")
   - (b) Method of cleaning (affects factor No. 4) ("a" or "b")
9. Temperature on Outside and Inside
   - (a) Low ("a" or "b")
   - (b) High ("a" or "b")
10. Pressure on Outside and Inside
    - (a) High ("a")
    - (b) Low ("b")
11. Galvanic Coupling ("b")
12. Physical Properties ("a" or "b")
    - (a) Hardness, (b) microstructure
    - (c) Fatigue Characteristics

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

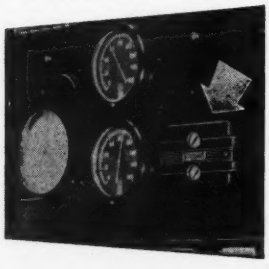
Here's Safety-Assuring Precision in Automatic PRESSURE CONTROL—

the extremely sensitive New

Swartwout Master Pressure Control

The safety you need for personnel, equipment and work in process requires dependable accuracy in controlling modern high pressures. Almost unbelievably sensitive in its reaction to pressure changes, the new Swartwout "P-2" Pressure Master Control acts instantly to hold forces to a narrow range through its control of regulating valves. It's a precision instrument of simple rugged construction. Requires but two adjustments. Handles problems of regulation of steam or other vapors and fluids. Assures stability of control for reducing, relief, spill-over, pump control and other functions.

Swartwout Type P-2 Pressure Master is compact, soundly engineered—is housed in a modern dust-proof case, easily accessible through front hinged door: a practical solution to many of *your* regulation problems.



Put your pressure regulation on a worry-free basis. Write today for Swartwout Data Unit No. S-203 describing the new P-2 Pressure Master Control.

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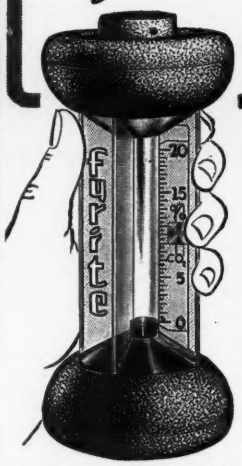
POWER PLANT EQUIPMENT
THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

BOOST FURNACE EFFICIENCY

BY USING THE *Simplified* FYRITE CO_2 INDICATOR



ACCURATE Flue Gas Tests in 40 Seconds!

FYRITE CO_2 readings instantly expose fuel wasted up the stack, indicating necessity of making adjustments that will secure the most efficient combustion. The FYRITE also helps detect heat losses due to air leaks in boiler settings, etc. It is indispensable to "cross-check" automatic combustion controls, and to assure proper compensating adjustments in the fuel-air ratio. The FYRITE is simple, sturdy; has no glass parts, no delicate electrical system. More than 11,000 are in successful use.

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$24.00 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

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Also Available!
OXYGEN INDICATOR
for DIRECT Oxygen Analysis

Employs FYRITE principle . . . Accuracy not affected by temperature and atmospheric conditions, or by presence of other gas in sample.

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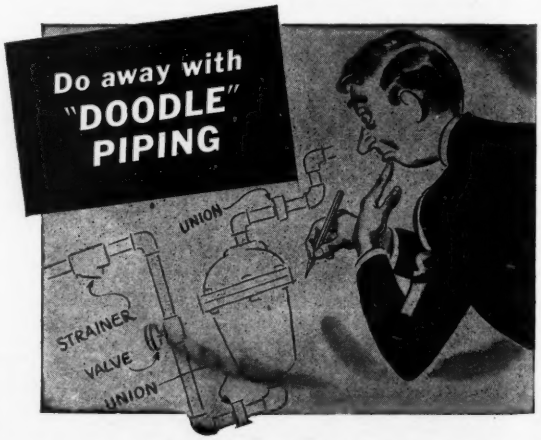
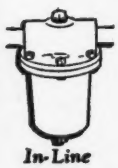




In-Line

Elbow

Piping of inverted bucket steam traps is wasteful if it looks like scratch-pad doodling—in at the bottom and out at the top. But, Anderson Super-Silvertop Steam Traps permit BOTH elbow and straight-in-line piping with only one fitting. This common sense improvement gives reduced installation costs without split (pierced) gasket or cored passages.

Simplify your piping with Super-Silvertop. You save in first cost, on installation costs, besides the satisfaction of clean-cut, neat piping layouts. Have you sent for your free copy of the book, "How To Choose A Steam Trap"? Write today.

THE V. D. ANDERSON COMPANY
1939 West 96th Street • Cleveland 2, Ohio

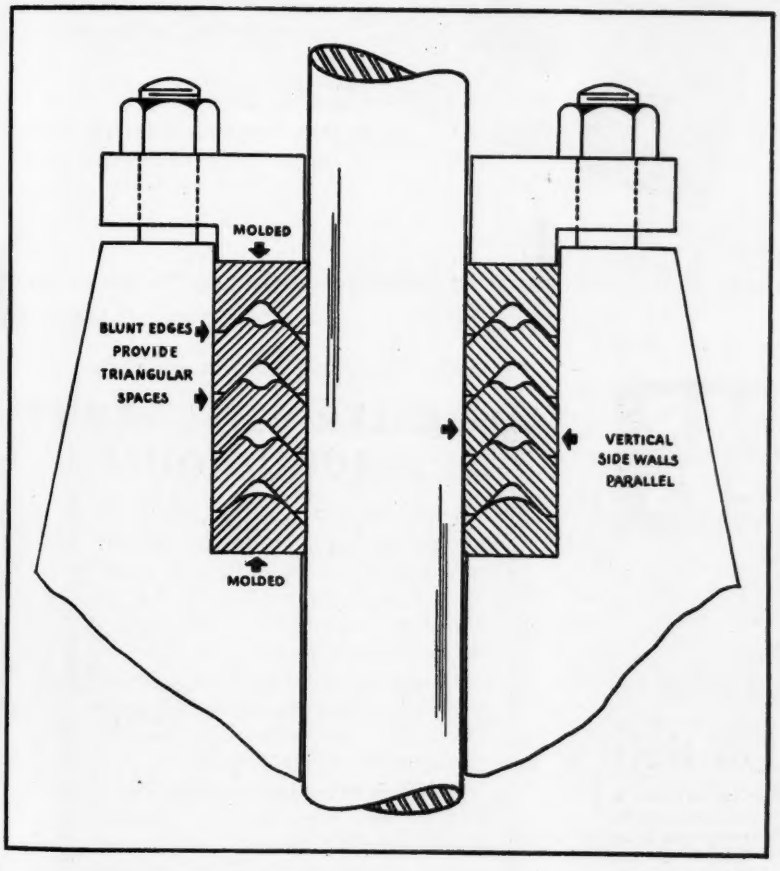
SUPER-SILVERTOP • STEAM TRAPS •

SERVING YOU THROUGH SCIENCE

Exclusive DESIGN!

U. S. MATCHLESS PACKING for rods and plungers

NO OTHER PACKING HAS ALL THESE ADVANTAGES



BLUNT EDGES—Give more efficient shape; allow fabric to reach end of packing, providing uniform strength throughout. In conventional packing (feather-edge design) fabric cannot be forced into sharp edge, leaving unprotected soft-rubber end to cause curling and chipping.

TRIANGULAR SPACES—Blunt edges provide triangular spaces for trapping loose scale, oil, etc. Result is lower coefficient of friction, less power required, and scaling does not score entire length of packing set.

PRESSURE BREAK—The triangular space of each ring breaks the pressure more quickly than ordinary types without this feature. With "Matchless" design, automatic action is faster, more effective.

MOLDED END RINGS—Tests show the female ring and the one next to it take 70% of the pressure on the set. In "Matchless" *all* rings are molded, are of proper density, and have no sharp edges to break off, as on end rings cut from slab.

EASY TO INSTALL—Matchless Packing has parallel side walls, while conventional packings are made with varying degrees of wall flare. "Matchless" rings slide easily into stuffing box; the flare type requires considerable effort and time.

For the past twenty-five years "Matchless" has been famous in industry for its unique advantages on hydraulic equipment, presses, rams, triplex pumps, outside packed pumps, and swivels on rotary drilling rigs. The self-adjusting, automatic action of "Matchless" results in reduced wear and tear on rods and plungers, minimizes friction and keeps down packing costs.

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Prevent Motor BREAKDOWNS *that cause Plant* SHUTDOWNS!

IDEAL MOTOR MAINTENANCE EQUIPMENT

New motors are still scarce; conserve the ones you have.

When Commutators and Slip Rings show signs of wear, when spitting and burning indicate high mica, etc., a few minutes use of IDEAL Motor Maintenance Equipment will restore original high efficiency. IDEAL Tools used periodically keep Commutators and Slip Rings "good as new" and prevent costly shutdowns.

❶ **RESURFACERS** (Hand Type) Remove pin ridges, roughness and small flat spots from Commutators and Slip Rings, while the armature rotates in its own bearings.

❷ **PRECISION GRINDERS** (with Tool Type Resurfacers) Restore surfaces that are badly scored and out-of-round. Easy to mount right on motor frame. No dismantling necessary.

❸ **MICA UNDERCUTTERS** (Power Driven) Undercut hardest mica, without taking down motor or generator.

OTHER IDEAL Motor Maintenance Equipment —Carbon Brush Seater, Commutator Cleaning Stone, Commutator Saws and Milling Cutters, Slotting Files, Hand Type Slotter and Scraper, etc.

Motor Equipment Division

IDEAL INDUSTRIES, Inc. *(Successor to Ideal Commutator Dresser Co.)*

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FYR-FEEDER MULTIPLE SPREADER STOKERS

Available Now!

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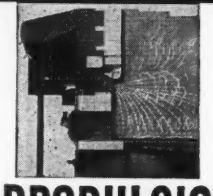

AIR JET COAL PROPULSION

• **FYR-FEEDER pays for itself in coal and labor savings. • Automatic, modern, high efficiency firing at its best! • Increases boiler capacity with cheapest grades of coal — screenings or sweepings, wet or dry. CUTS FUEL BILLS! • Easy to operate. Responds instantly to sudden load changes. Burns fines in suspension; larger pieces on grate. Beautifully clean flame. • Safe, Dependable. Multiple Burners. Quality construction. • Easily installed in minimum time. Standard ratings from 100 to 12,000 lbs. of coal per hour. Wire, phone, or write.**

FYR-FEEDER *Multiple* SPREADER STOKER
IT'S EFFICIENT
IT'S AUTOMATIC
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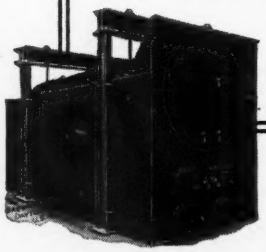
OLD BOILER STILL PERKY IN ALBUQUERQUE!

"All the original flues are still in it, and there are no signs of leaks," writes an Albuquerque (New Mexico) laundryman about a Brownell 80 hp. H.R.T. Boiler which has been in constant operation since 1928.

Though this boiler would be good for many more years, the laundry has outgrown it. So, the present requirement is a Brownell H.R.T. 150-hp. boiler.

This is an example of customer satisfaction. Much of our business consists of reorders from satisfied customers — and we've acquired a lot of them during our 91 years of building boilers, stokers, and water heaters.



Brownell Horizontal Return Tubular Boiler with steel casing; capacities of 20 to 250 hp. One of the nine types of Brownell Boilers.

THE **BROWNELL** COMPANY
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SERVICE ALL THE WAY

OTIS MAINTENANCE FOR OTIS ELEVATORS

● Otis Maintenance extends all of the facilities and ability of the manufacturer directly to the buildings of Otis elevator owners.

To bring this service to your door, Maintenance operations are conducted by 245 local Otis offices, each adapted to the area it serves. These branch offices in turn have the benefit of progressive improvements in service developed by the facilities that produced more than half of the world's elevator equipment. Thus Otis Maintenance goes all the way to meet the convenience of the Otis elevator owner.

Few things you buy can so exactly fit your needs.

Maintenance by Otis, for Otis elevators, is available at a flat monthly rate through your local Otis Elevator Company office.

Otis ELEVATOR COMPANY

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"THERE'S NO FLANGE LIKE A PHOENIX FLANGE"

When it comes to providing the utmost in safety, service, and satisfaction . . . there's no flange like a Phoenix Flange.

Here are 4 good reasons why:

1. They're drop forged so that grain flow of metal is positioned to provide maximum strength and toughness in those portions of the flange where it is most needed.

2. They're made of mild steel especially adaptable to welding and machining, and are available in a wide range of styles and sizes. Phoenix Flanges made of stainless steel, Everdur brass, and other alloys are also obtainable.

3. They're Normalized and Annealed for long wear and strength, in precision-controlled heat treating furnaces.

4. They're lacquer finished to resist rust and corrosion.

Every Phoenix Flange complies with ASA requirements and ASME and ASTM specifications.

For safety, service and satisfaction, specify Phoenix Flanges. Write for your free copy of the new Phoenix Flange Catalog today.

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FLANGES

Flange Division of

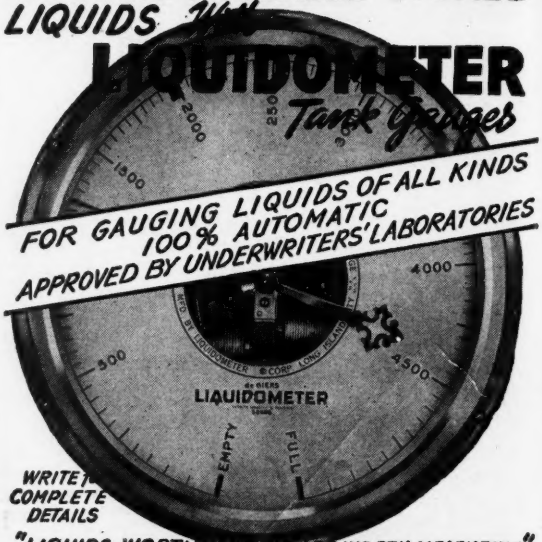
PHOENIX MANUFACTURING COMPANY

Catasauqua, Pa. Joliet, Ill.

COSTLY HUMAN ERRORS ELIMINATED WHEN YOU MEASURE VALUABLE STORED LIQUIDS WITH

LIQUIDOMETER Tank Gauges

FOR GAUGING LIQUIDS OF ALL KINDS
100% AUTOMATIC
APPROVED BY UNDERWRITERS' LABORATORIES



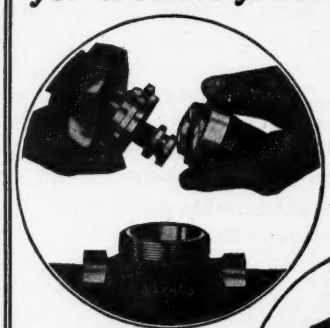
WRITE FOR COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
36-31 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

Use VULCODISC

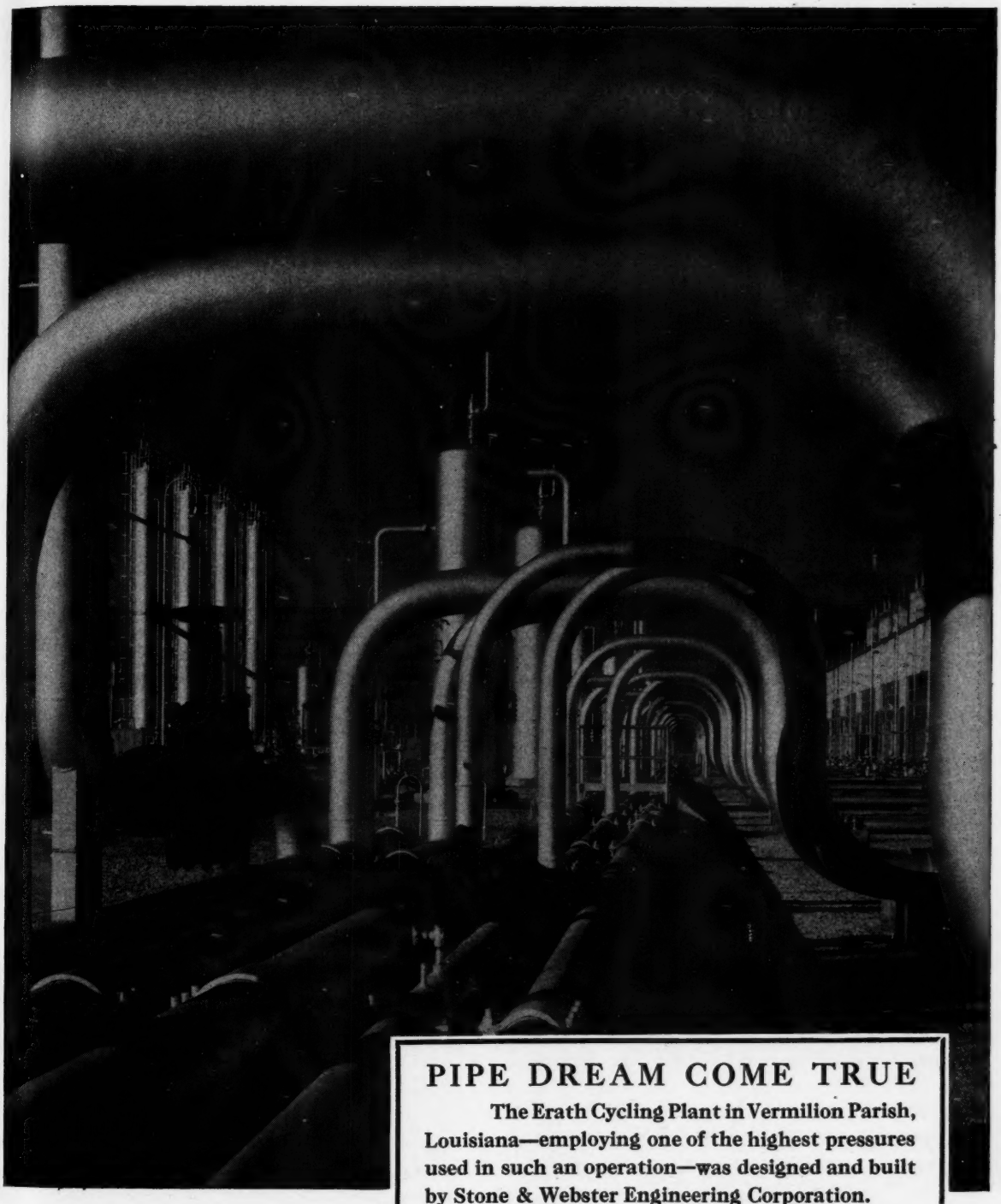
for trouble-free valve jobs



In renewing the disc, note how easily and quickly the Vulcodisc Jiffy Disc Holder slips off the stem head. Only the disc lock nut to remove and the old disc is off and replaced in a jiffy.

Dense without being brittle — tough, yet resilient, Vulcodisc will not swell, warp or soften—in fact, its absorption is less than 1 per cent. . . . That is why an old Vulcodisc comes out of the disc holder as easily as a new one goes in. No need for hammer and chisel to cut the disc out in pieces—distorting and disfiguring the holder.

THE D. T. WILLIAMS VALVE CO.
Cincinnati, Ohio



PIPE DREAM COME TRUE

The Erath Cycling Plant in Vermilion Parish, Louisiana—employing one of the highest pressures used in such an operation—was designed and built by Stone & Webster Engineering Corporation.

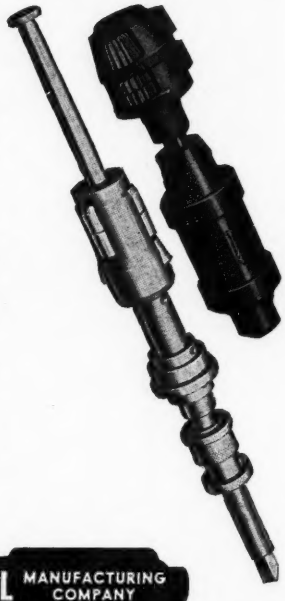
We offer industry wide experience in engineering and construction problems—from the most complicated to the simplest.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER INC.

This Baby Is TOUGH!

AIRETOOL TUBE CLEANERS CRACK-DOWN ON SCALE



Airetool Tube Cleaners and Expanders have the "guts" of champions . . . they take it on the chin and keep boring in . . . they don't stop!

Airetool engineers know that there is no place for a tool that must be pampered. They know that in the power industry, or in any other highly competitive industrial field, it's results that count, it's the ability to take rough and tumble handling and come up with a precision job that pays off.

So Airetool cleaners and expanders are *tough babies* . . . yet they retain split hair precision. Airetool Cleaners keep tubes at a high efficiency level and Airetool expanders roll out joints in a smooth perfection that high pressures and temperatures demand.

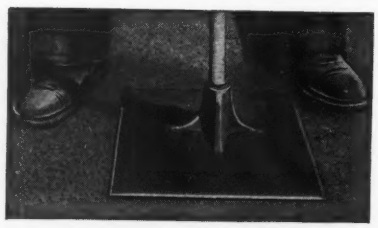
There is an Airetool Cleaner and Expander for every job you have. Cleaners with either the cutter or brush head types are available for curved and straight tubes in sizes from ½" to 24" I.D. Airetool expanders are made in sizes from ½" to 12" I.D.

Write Airetool Manufacturing Co., Dept. PY, Springfield, Ohio, for further information and informative booklets.

AIRETOOL MANUFACTURING COMPANY

SPRINGFIELD, OHIO

TRY IT!



NEW PLASTIC FLOOR PATCH SETS INSTANTLY

Tamp! Truck Over! No Wait for Setting!

Flexrock offers a new plastic repair material which is ready for traffic almost the moment it's put down. There is no waiting. Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is restored to solid smoothness. Tough INSTANT-USE bonds tight to old concrete, makes long-lasting heavy duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER

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INSTANT-USE

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Please send me complete INSTANT-USE information and details of FREE TRIAL OFFER—no obligation.

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HOW OUR MEMBERSHIP IN ABP*

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Teaming up with The Associated Business Papers helps Power Plant Engineering do a more timely, heads-up editorial job. For example, it brings us closer to Industry, Trade and Government through the National Conference of Business Paper Editors which meets regularly in Washington with the most important men in Congress, the White House and other departments of Government, and in other large centers with business and labor leaders.

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A major aim of The Associated Business Papers is to aid advertisers get a bigger return on their investment. Its own field work, like that of publisher members, shows that business paper readers want and need meaty, idea-ful advertising copy. Thus, a major ABP activity has been the publishing of workbooks for sales and advertising men.

These guides for planning more resultful business paper advertising include: The "Tell-All" book, "Intensive Advertising," "How I Hamstrung My Advertising Agency," "Finding Out," "Hit the Road for Better Business Paper Advertising." If you would like copies of any of those books drop a note to the Advertising Manager, Power Plant Engineering.

*CHARTER MEMBER

YOUR MAXIM SILENCER CHECK LIST

Check the four types of Maxim Silencers shown against silencing applications in your plant. Each type is available in various sizes to fit specific installation requirements. Detailed information on any of these silencers will be sent on request.

EXHAUST & INTAKE SILENCERS

These Maxim Silencers are designed to silence the exhaust or intake of internal combustion engines, steam engine exhaust, air compressor intake, vacuum pump discharge and the intake or discharge of blowers of the positive pressure type.

SPARK ARRESTOR SILENCERS

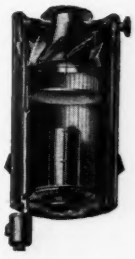
Maxim Spark Arrestor silencers effectively silence exhaust noise and in addition trap 100% of all exhaust sparks and embers. Widely used in the marine field and in industry where a fire or dirt nuisance hazard exists.

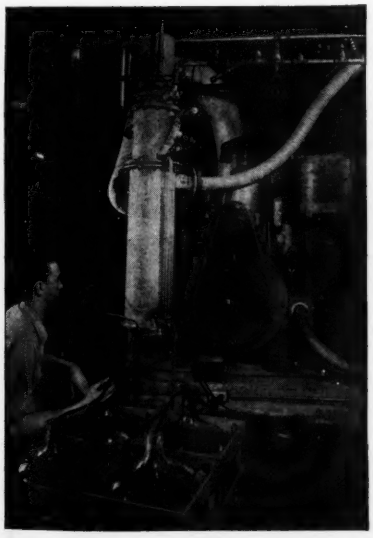
STEAM BLOW-OFF SILENCERS

These silencers were developed for use on installations involving the discharge of high velocity steam, air or gas to atmosphere. They are used to quiet the roar of steam blow-off, safety valve discharges, etc.

HEAT RECOVERY SILENCERS

Maxim Heat Recovery Silencers combine efficient silencing of engine exhaust with spark arresting (where necessary) and with the recovery of waste exhaust heat to produce steam or hot water for heating or processing operations.





THE NEW MAXIM EVAPORATOR

Maxim Evaporators are installed in the exhaust line of internal combustion engines and use, as their source of heat, engine exhaust heat that is usually wasted. They provide a practical, low cost method of insuring a constant supply of distilled water or fresh water from any source. They produce approximately one gallon per hour for every 10 h.p. of engine rating.

The Maxim Evaporator shown here at the Cosmic Radio Corporation plant in New York City operates on the exhaust of a 75 h.p. Diesel and supplies approximately 6½ gallons of distilled water per hour to a purity of 3 parts per million.

THE MAXIM SILENCER CO.

89 HOMESTEAD AVE. HARTFORD 1, CONN.

ARMY ★★ E ★★ NAVY

MAXIM

PACKING
ROD and SHEET

QUAKER
ROD
PACKINGS
A Complete Line of
Rubber
Duck and Rubber
Flax
Hydraulic
Asbestos
Metallic
Semi-Metallic
for all types of Service Conditions

REG. U.S. PAT. OFF.

QUAKER
SHEET
PACKINGS
Rubber
Asbestos
Fibre
For all service applications

The purpose of packing is to prevent leakage. Every plant of necessity must use some type of rod and sheet packings.

To the Engineer or Maintenance Superintendent it is highly important to see that packings are properly selected and properly made for the service intended.

It is a most annoying task for anyone to find it necessary to repeatedly repack leaky stuffing-boxes or pipe joints. When proper Quaker packings are correctly applied you do not have to worry about frequent leaks.

Quaker has been manufacturing a complete line of Rod and Sheet Packings for over sixty years. Then, too, we maintain an expert engineering force to give you explicit information on your own packing conditions. This is supplemented with Quaker representatives who are located right in your own section, who are ready on immediate call to help you.

Regardless of whether you have an unusual condition in which oil, asphalt, acid, chemical or any other fluid that makes a severe service condition, Quaker has a brand to meet it.

Specify Quaker on your Rod and Sheet Packing orders and buy through the Distributor.

"If there is a way to get it done—Quaker will do it"

QUAKER RUBBER CORPORATION
Mfrs. Industrial Rubber Products
PHILADELPHIA 24, PENNSYLVANIA
NEW YORK • CHICAGO • CLEVELAND • HOUSTON
Western Territory
Quaker Pacific Rubber Company
San Francisco • Los Angeles

HOW
MAGIC
BOILER PRESERVATIVE
Guards 2 Ways Against Corrosion

Corrosion occurs when oxygen or acid gases act on metal. Oxygen and carbonic acid gas are found dissolved in all natural waters to a varying degree. Hydrochloric acid gas is formed under steaming conditions, when chlorides of iron, magnesium, calcium or sodium are present in feedwater. The liberation of hydrochloric acid gas from these substances is accelerated by the presence of sulfates of calcium and magnesium. Carbonic acid gas is liberated from bicarbonates of calcium and magnesium.

MAGIC Boiler Preservative acts in two ways to guard against corrosion. First, the MAGIC dissolved in the boiler water "binds" acid gases and represses their liberation. Second, the MAGIC film of protection keeps corroding substances from contact with the metal.

Write for Descriptive Bulletin.

GARRATT-CALLAHAN CO.
Established 1904
OF ILLINOIS — 59 East Van Buren St. Chicago 5
OF NEW YORK, Inc. — 1328 Broadway New York City 1
OF CALIFORNIA — 148-156 Spear St. San Francisco 5

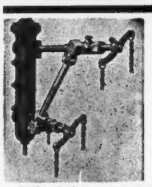


FIG. 4-F

GAGES AND GUARDS
for Boilers, Tanks, Etc.
All shipments from stock. Send for catalog.

FIG. 13

FIG. 9

Ernst WATER COLUMN & GAGE CO.
Livingston, N. J. Livingston 6-1400

Squires Reducing Valve

Will maintain the constant pressure desired regardless of initial pressure. It is a dead end valve.

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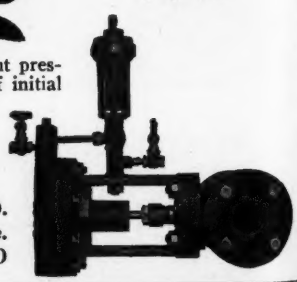

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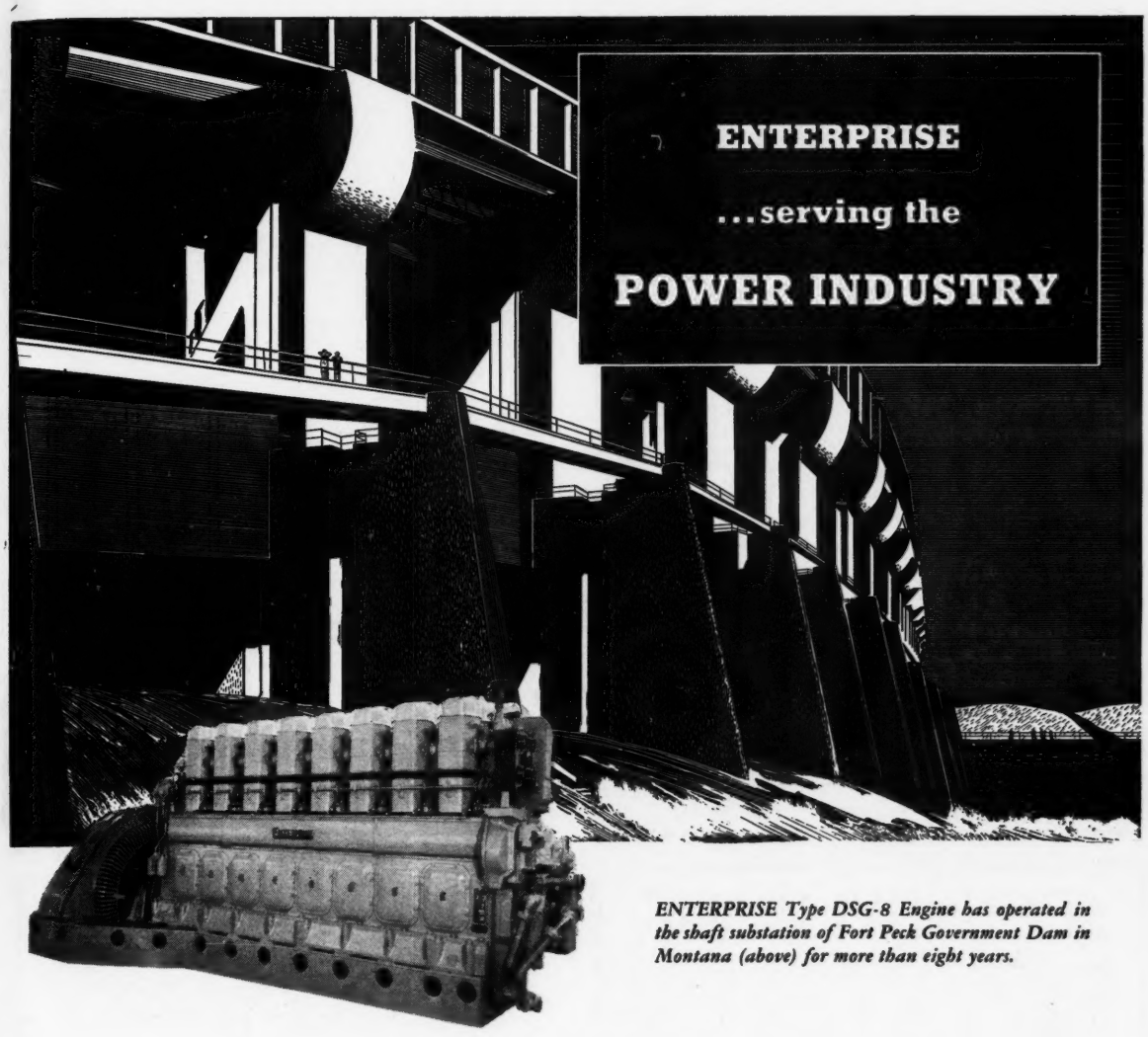

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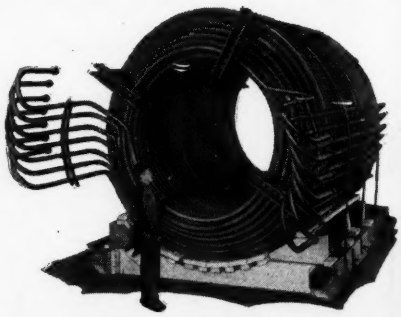

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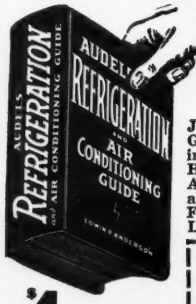

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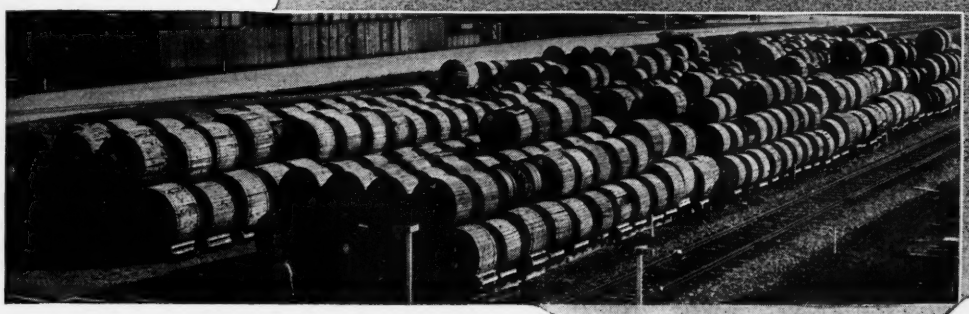

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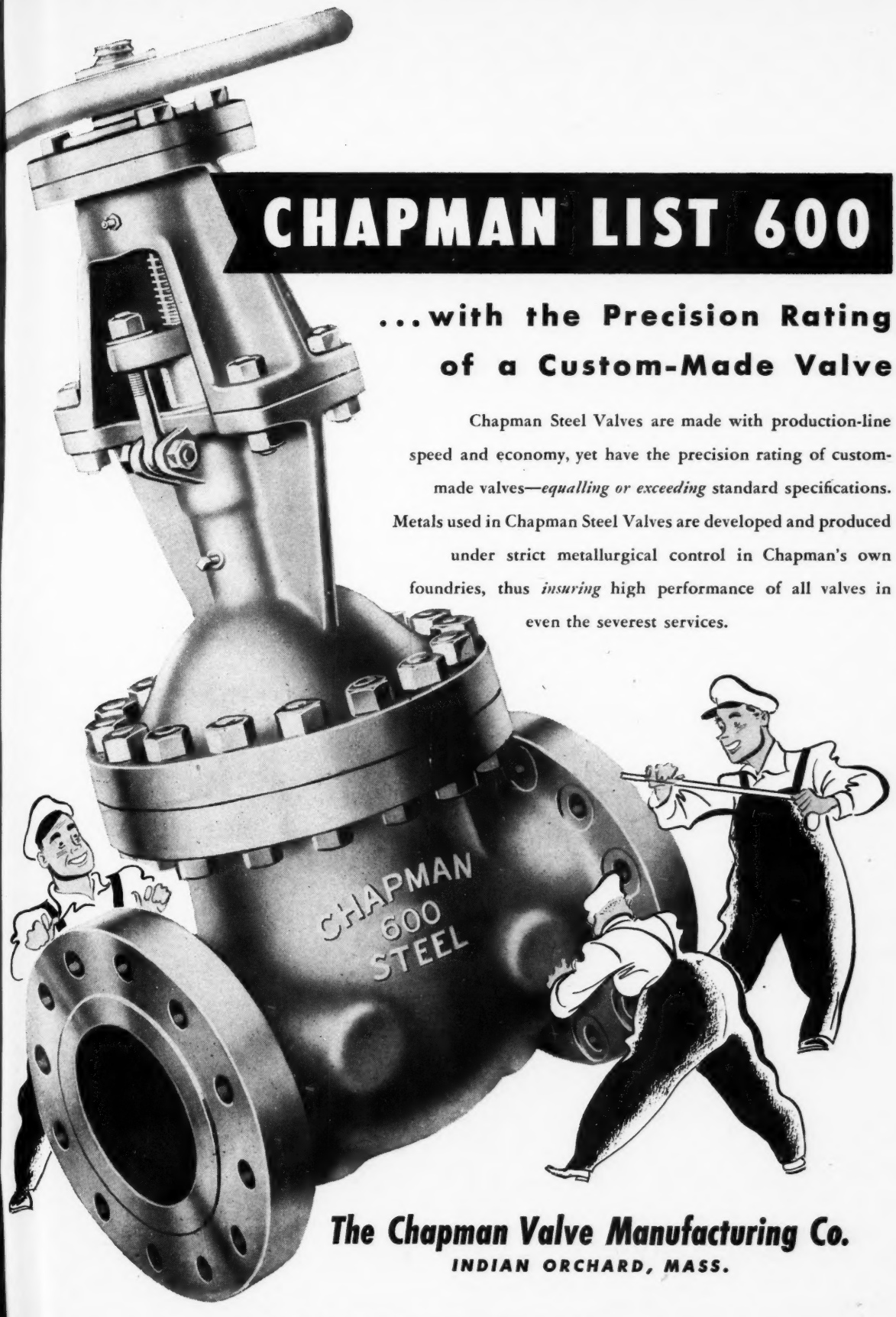

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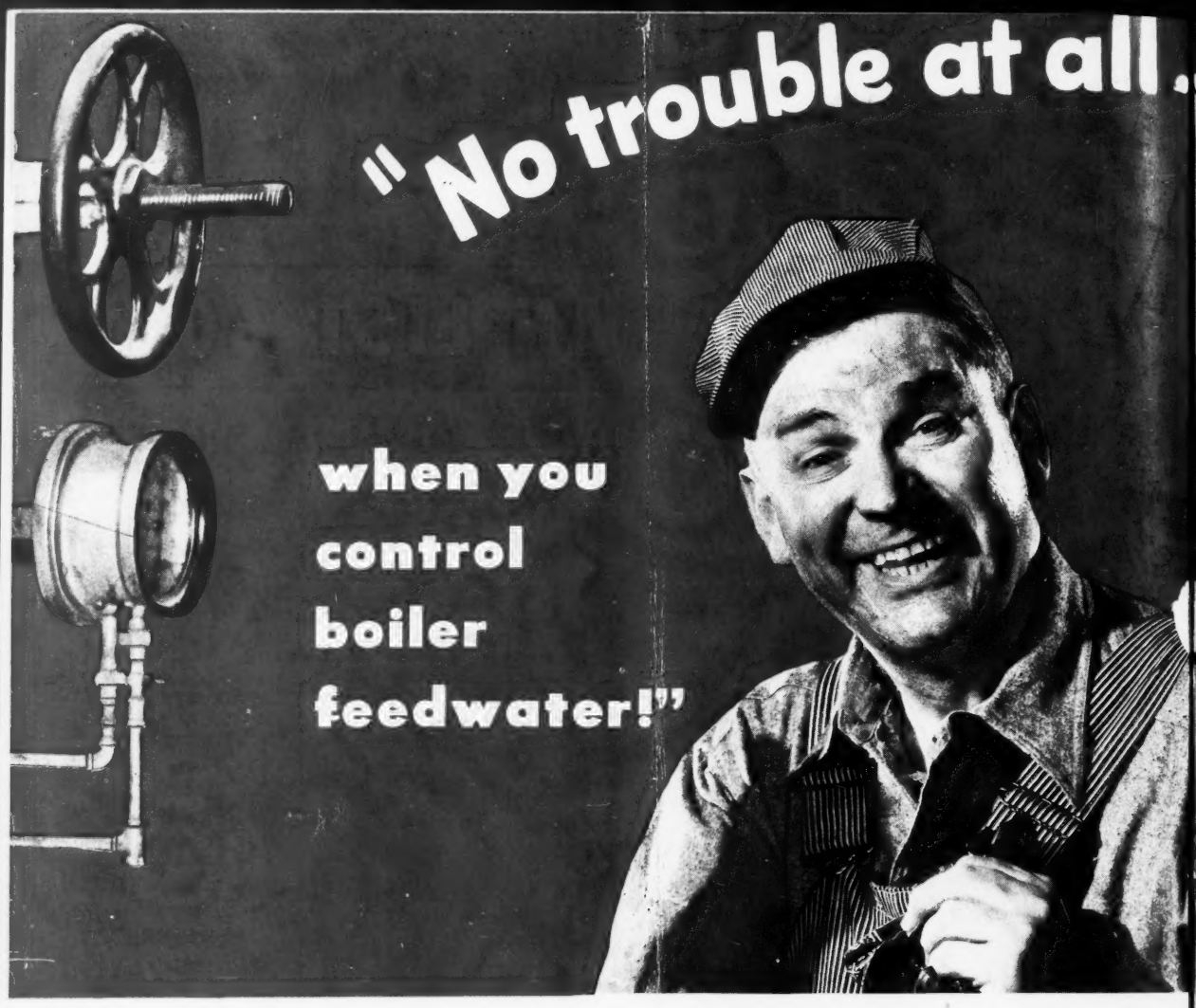

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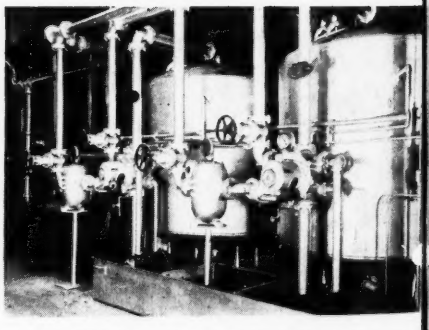

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